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Achieving Operational Efficiency at PowerStream

Presented by **Vince Polsoni, PowerStream Inc.**

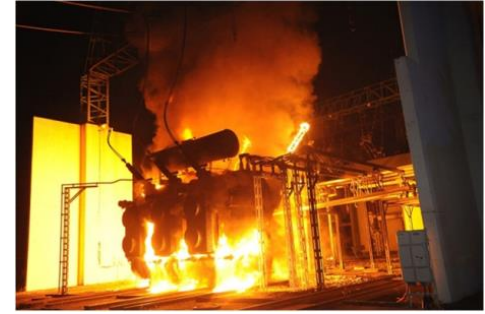


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Equipment Failures to Avoid



**Your Last
Failure
Here**



Agenda – Achieving Operational Efficiency

Operations - Asset & Maintenance Management

- PI System at PowerStream
- PI System integration with CMMS
- PI Data and Reporting Methods
- Technology and Innovation
- PI Dashboards



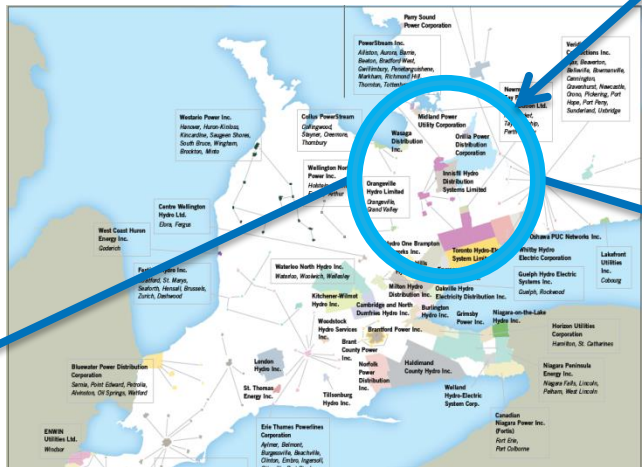
Where Are We?



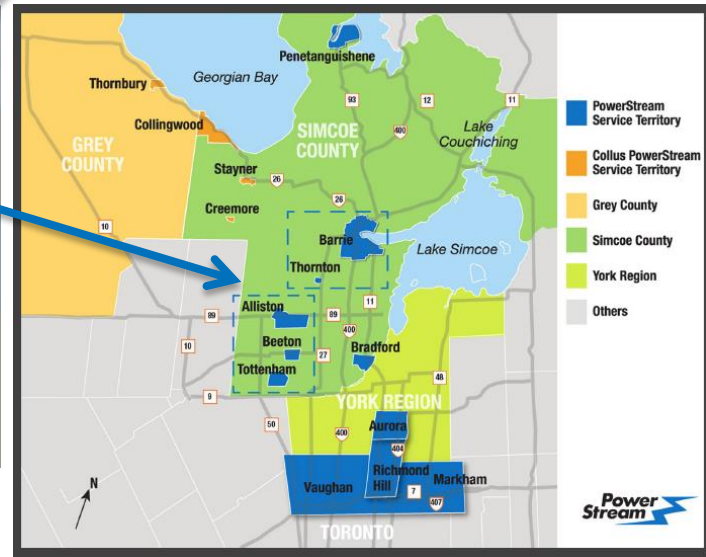
Ontario
1,068,587 km²



Germany
357,021 km²



Powerstream Service Territory



Powerstream Service Territory

- 806 km²
- 11 Municipalities
- Located just North of Toronto



PowerStream Fast Facts

- 2nd Largest Municipally owned Local Distribution Co. (LDC) in Ontario, Canada
- Serving 11 Communities through Central Ontario (Serving over 1 million residents)
- 550 Employees
- 350,000 Customers (Residential - 89%, Commercial Ind. - 11%)
- Total Revenue: **\$788 Million**
- Total Assets: **\$1,087.5 Million**
 - Overhead Circuit Wires: **2,500 km**
 - Underground Cable: **4,900 km**
 - Transformer Stations (TS's): **11**
 - Municipal Substations (MS's): **55**
 - Distribution Transformers: **43,000**
 - Switchgears: **1,800**
 - Poles: **40,000**
- Peak Demand: **1,972 MW**
- Geographical Size of Service Territory: **806 Sq. Km**
- Distribution Voltages **4kV, 8kV, 13.8kV, 27.6kV and 44kV**

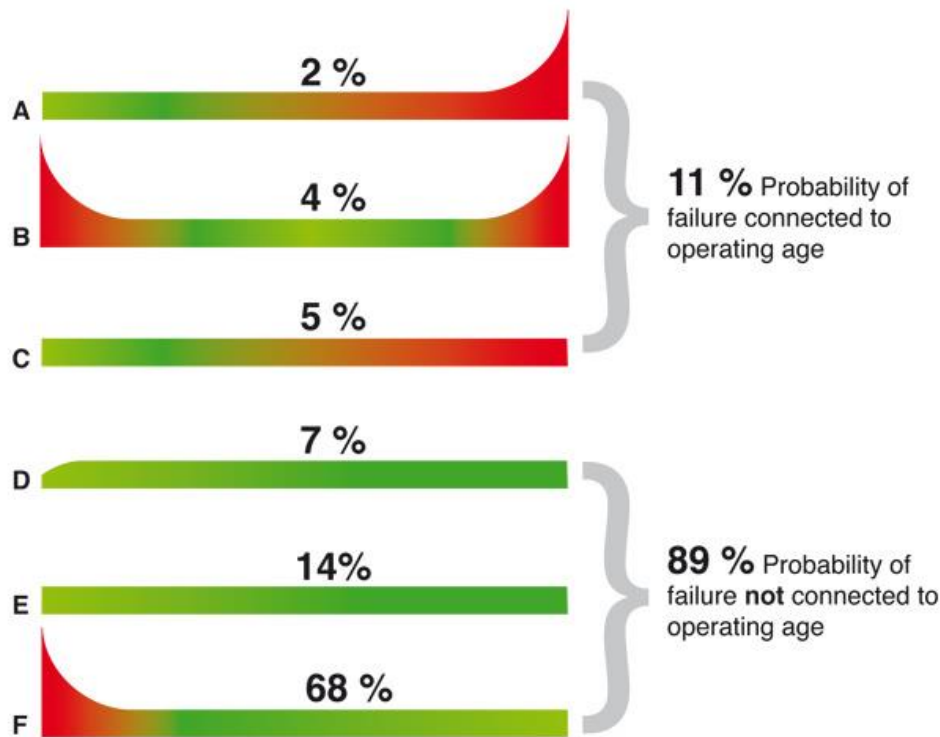


Station Assets Maintained by Station Sustainment and P&C



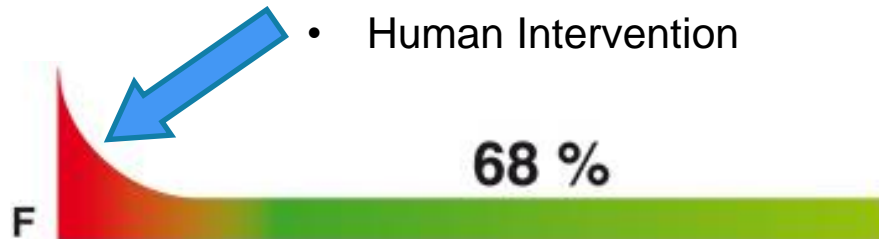
The Plan

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



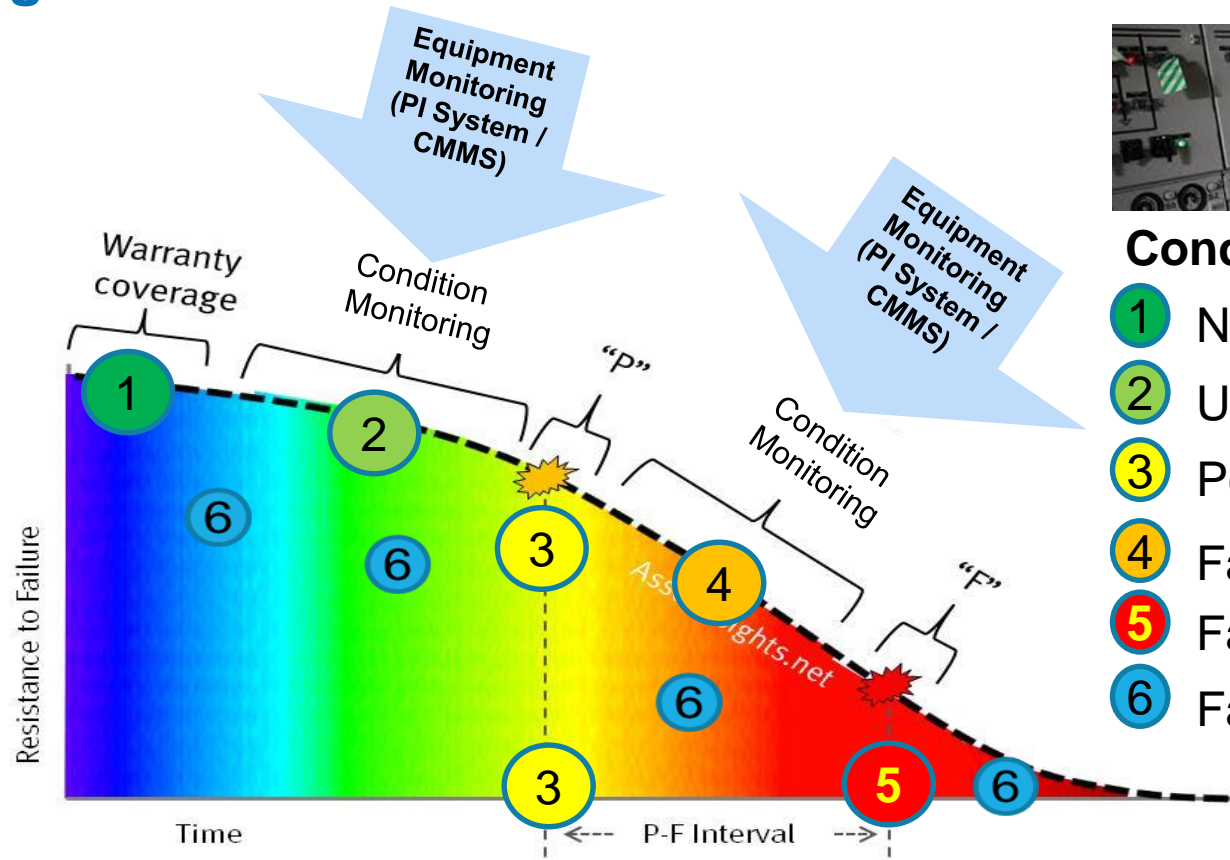
**if it ain't
broke don't
fix it**

- Premature random failures
- Human Intervention



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

Using Potential Failure “PF” Curve – Condition Monitoring Scoring



Equipment Monitoring (PI System / CMMS)

Equipment Monitoring (PI System / CMMS)



Condition Score

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

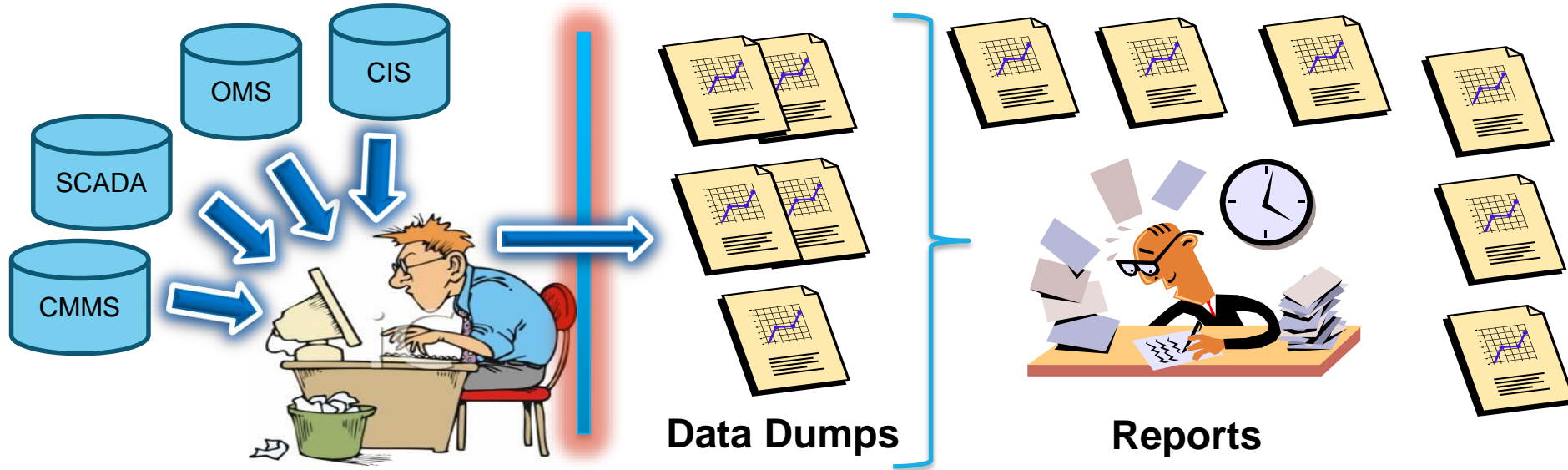
Optimized Station Maintenance at PowerStream

- Risk based Condition Based Maintenance (PI System and CMMS)
- RCM2 methodology incorporated into CMMS
- Instant Information (true real-time)
 - Instant Notifications from PI System (real-time)
 - Alerts from Computerized Maintenance Management System (CMMS)
 - PI System Reports
- Automatic Maintenance Work Orders triggered by Events in SCADA via the PI System
- Field staff aware of equipment condition/health/risk
- Better Reporting and Asset Health assessments
- One data source



Operations Reporting - Life Before the PI System

- Reports generated monthly
- Data is overwritten based on **frequency** of data point collection in some databases (e.g. SCADA)
- Archived/Historical data is often extracted and stored in flat files (spreadsheets)



PI System at Powerstream



2012

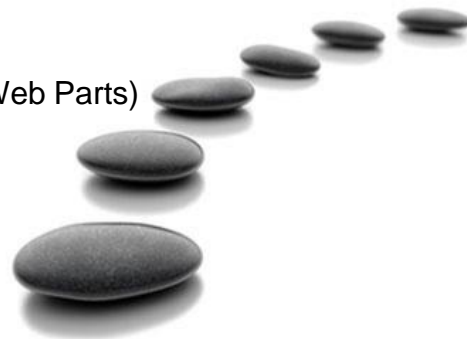
- Implementation – **5000 tags**, PI ProcessBook, PI DataLink
- Justified as part of Computerized Maintenance Management System (CMMS) implementation strategy

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 Web Parts)
 - Operational Reports (PI ProcessBook, PI Coresight, PI DataLink, PI Web Parts)

2016

- PI System Review and upgrade
- **Event Frames**
- **PI Integrator for Esri ArcGIS, Merger (add new assets)**



PI System Products Used at Powerstream

30,000 tags
(and growing)

- PI ProcessBook
- PI Coresight
- PI WebParts
- PI DataLink
- PI Asset Framework (AF)
- PI SMT, PI Explorer, PI ICU
- PI HTML Interface
- PI UFL Interface
- PI RDBMS Interface
- **PI Integrator for Esri ArcGIS**
- Templates
 - Element
 - Notifications
 - **Event Frames**






Equipment Monitoring – Key for CBM

- Microprocessor Relays
- Online Transformer Gas in Oil Monitoring Units
 - (7 Gas) DGA monitors on 55/83 MVA and 75/125 MVA transformers
 - Hydrogen monitors on 5 to 20 MVA transformers
- Portable DGA testers
- Tap Changer Filtration Systems, Transformer Oil Dry-out Filtration System
- Online Bushing Monitoring Systems
- Maintenance Free Dehydrating Breathers
- Station Equipment Temperature Sensors



Leveraging PI System at Powerstream

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



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 the PI System

Real-time Alerting

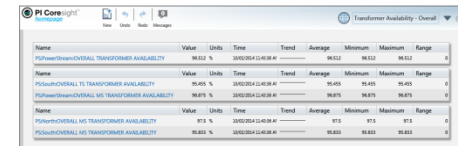
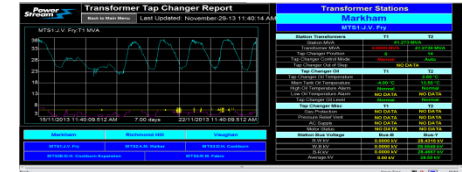
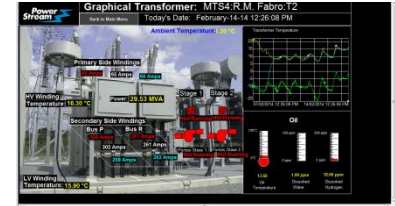
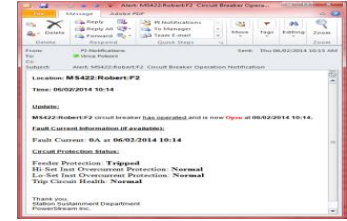
- Notifications and Alerts (Real-time)
- Provide meaningful information to key Operations Staff

Asset Condition & Analytics

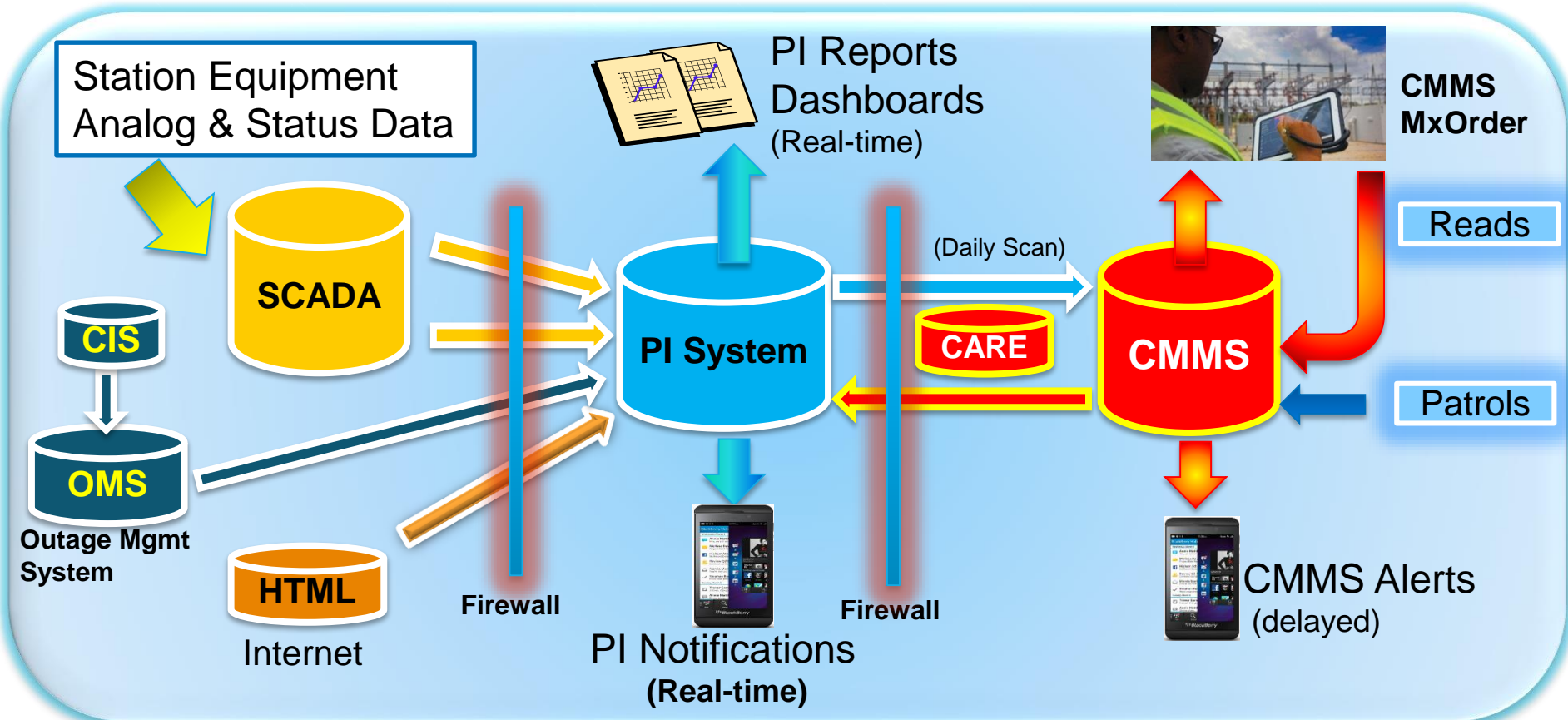
- Instant Asset Condition Assessment, Criticality, Health, Risk and Priority (PI System and CMMS)

User Friendly Simple Tools

- PI Coresight / PI ProcessBook and PI DataLink
- PI Asset Framework (AF) and Templates
- PI Interfaces, Use various display tools



Condition Based Maintenance - Data Flow



PI Data Used in CMMS to Trigger Maintenance Tasks

Transformer:

- 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

Circuit Breaker:

- Operations in last 24 hours and last six months
- Max Amps
- Fault Current
- SF6 Gas Alarm

DC System:

- Low Battery Alarm

High Water Alarms



Integrated Products

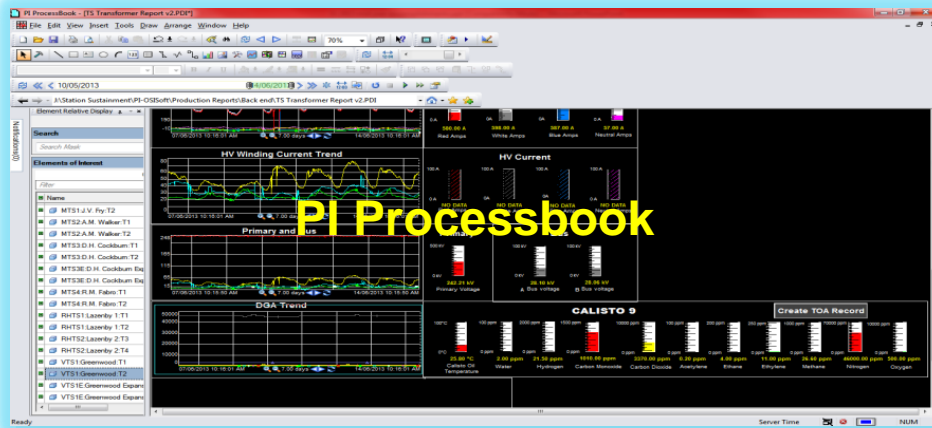


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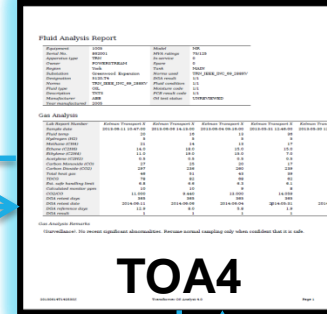
Expert Systems Working in Unison



Dissolved Gas Analysis in Transformer PI ProcessBook, TOA4 and CMMS



PI Processbook



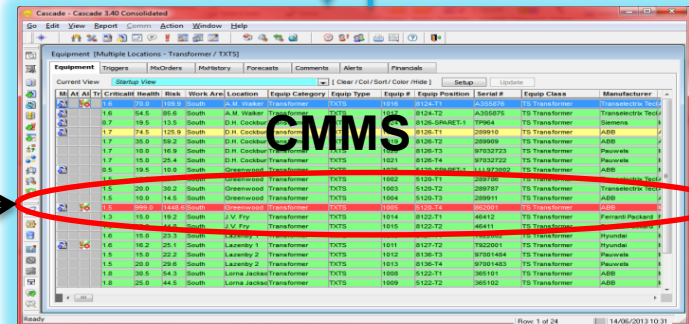
TOA4



Daily Synch
or On Demand

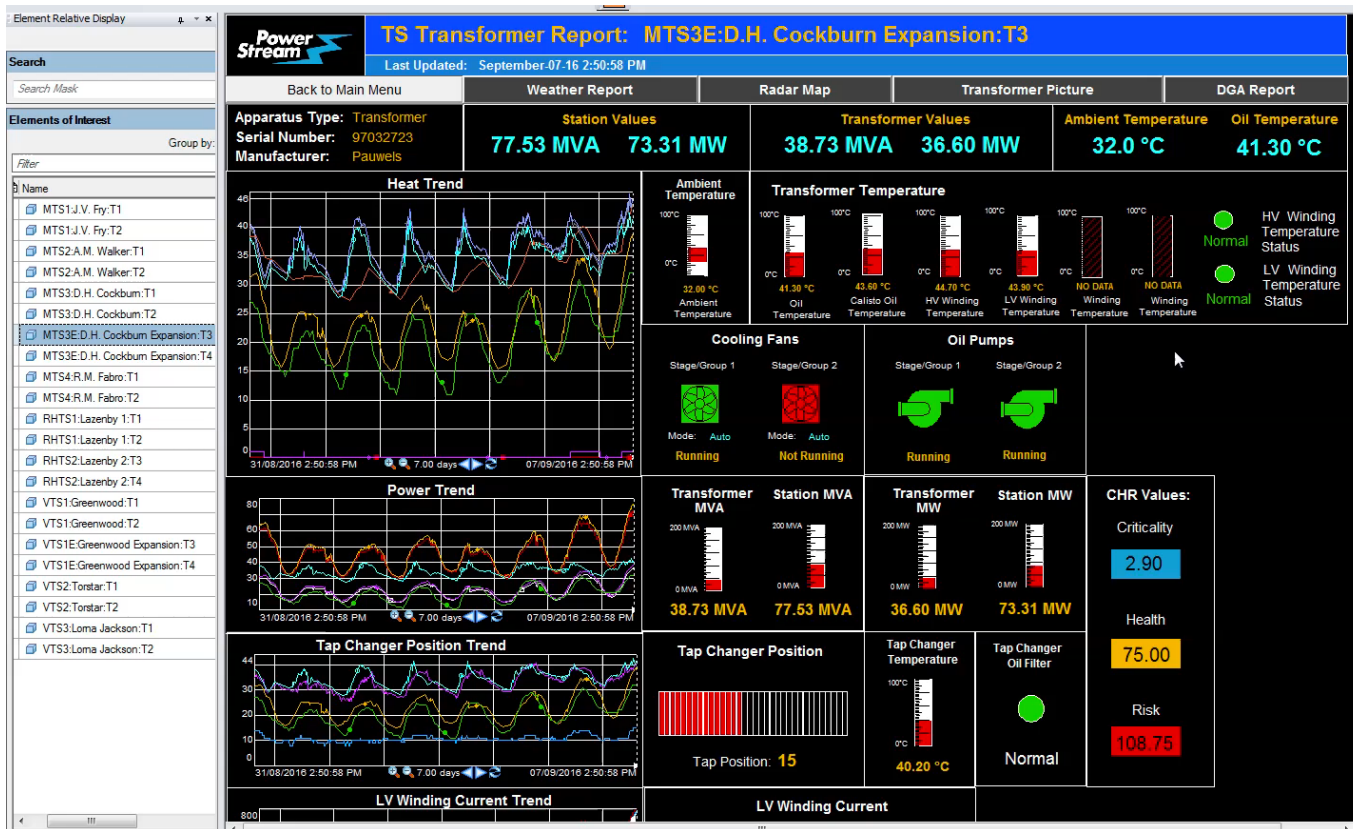
Daily synch

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





CMMS


Real-Time Transformer Oil Analysis - Video




TS Transformer Oil Condition Report

PI Coresight

TS Transformer DGA Report_v2

Ad Hoc Display



TS Transformer DGA Report

Markham	TX #	Type	DGA Result	Moisture Result	DGA&Moisture Test Date	Fluid Quality	Fluid Quality Test Date
MTS1:J.V. Fry	T1	TRN	1	1	6/29/2016 3:00:00 PM	2	7/13/2015 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 3:01:00 PM	2	7/13/2015 12:00:00 AM
		LTC	2		5/10/2016 12:00:00 AM	1	5/10/2016 12:00:00 AM
MTS2:A.M. Walker	T1	TRN	1	2	7/13/2015 12:00:00 AM	1	7/13/2015 12:00:00 AM
		LTC	4		5/24/2016 12:00:00 AM	1	5/24/2016 12:00:00 AM
	T2	TRN	1	2	7/13/2015 12:00:00 AM	1	7/13/2015 12:00:00 AM
		LTC	3		5/24/2016 12:00:00 AM	1	5/24/2016 12:00:00 AM
MTS3:D.H. Cockburn	T1	TRN	1	1	6/29/2016 3:01:00 PM	1	7/22/2015 12:00:00 AM
		LTC	2		5/4/2016 12:00:00 AM	1	5/4/2016 12:00:00 AM
	T2	TRN	1	1	6/29/2016 3:01:00 PM	1	7/22/2015 12:00:00 AM
		LTC	1		5/4/2016 12:00:00 AM	1	5/4/2016 12:00:00 AM
MTS3:D.H. Cockburn Expansion	T3	TRN	1	1	6/29/2016 3:02:00 PM	2	7/22/2015 12:00:00 AM
		LTC	2		5/4/2016 12:00:00 AM	2	5/4/2016 12:00:00 AM
	T4	TRN	1	1	6/29/2016 3:02:00 PM	2	7/22/2015 12:00:00 AM
		LTC	2		7/22/2015 12:00:00 AM	1	7/22/2015 12:00:00 AM
MTS4:R.M. Fabro	T1	TRN	1	1	7/15/2015 12:00:00 AM	1	7/15/2015 12:00:00 AM
		LTC					
	T2	TRN	1	1	7/15/2015 12:00:00 AM	1	7/15/2015 12:00:00 AM
		LTC					

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

Vaughan	TX #	Type	DGA Result	Moisture Result	DGA&Moisture Test Date	Fluid Quality	Fluid Quality Test Date
VTS1:Greenwood	T1	TRN	1	1	6/29/2016 3:04:00 PM	2	7/9/2015 12:00:00 AM
		LTC	2		5/6/2016 12:00:00 AM	2	5/6/2016 12:00:00 AM
	T2	TRN	1	1	6/29/2016 3:04:00 PM	2	7/9/2015 12:00:00 AM
		LTC	3		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
VTS1:Greenwood Expansion	T3	TRN	1	1	6/29/2016 3:04:00 PM	2	7/9/2015 12:00:00 AM
		LTC	1		1/28/2015 12:00:00 AM		
	T4	TRN	1	1	6/29/2016 3:04:00 PM	1	7/9/2015 12:00:00 AM
		LTC					
VTS2:Torstar	T1	TRN	1	1	6/29/2016 3:05:00 PM	1	7/9/2015 12:00:00 AM
		LTC	2		5/6/2016 12:00:00 AM	1	5/6/2016 12:00:00 AM
	T2	TRN	1	1	6/29/2016 3:05:00 PM	1	7/9/2015 12:00:00 AM
		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					

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

6/30/2016 12:44:06 AM

◀

8h

▶

Now

6/30/2016 8:44:06 AM

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

6/30/2016 12:44:06 AM



8h



Now

6/30/2016 8:44:06 AM



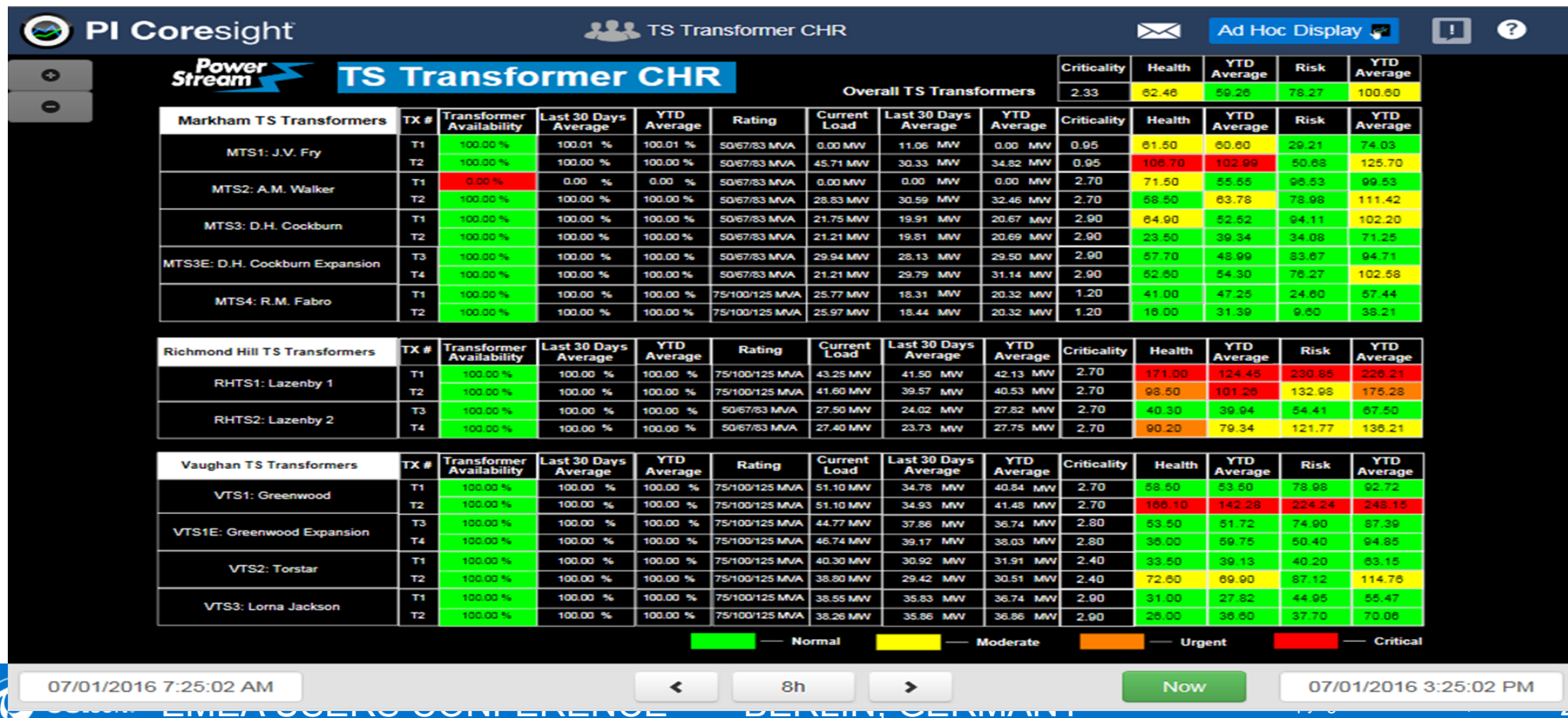
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TS Transformer Criticality, Health and Risk Report



Criticality, Health and Risk – PI System and CMMS

(From OMS to PI System to CMMS to PI Reports)



Criticality

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



Health

- Inspections, Maintenance
- PI Data
- Oil Condition
- Insulation Condition
- Failure, Equipment status
- Number of Customers per Feeder/Station
- Number of Open Work Orders
- Age


Risk

- Function of Criticality and Risk



Risk


Noticeable Changes to Maintenance Programs since implementation of PI System and CMMS

 Dramatic increase in Visibility and Awareness of Asset Condition and Status

 Decrease Emergency Maintenance Tasks

 Increase Corrective Maintenance Tasks

 Decrease in Preventive / Predictive Maintenance Tasks

  Detective Maintenance

  Equipment Reliability



Monitoring Our Station Equipment Monitoring Units

PI Coresight Transformer Monitor Status Report

Power Stream

Transformer Monitor Status

Station	TX #	Tap Changer Oil Filter Status	Bushing Monitor Status	Main Tank Oil Breather Status	RTU	Calisto 9 Alarm	Error
MTS1: J.V. Fry	T1	Normal		Normal	Normal	Normal	Normal
	T2	Normal		Normal	Normal	Normal	Normal
MTS2: A.M. Walker	T1	Normal					
	T2	Normal					
MTS3: D.H. Cockburn	T1	Normal			Normal	Normal	Normal
	T2	Normal			Normal	Normal	Normal
MTS3E: D.H. Cockburn Expansion	T3	Normal			Normal	Normal	Normal
	T4	Normal	Normal		Normal	Normal	Normal
MTS4: R.M. Fabro	T1						
	T2						
RHTS1: Lazenby 1	T1	Normal			Normal	Normal	Normal
	T2	Normal			Normal	Normal	Normal

24/03/2016 7:59:39 AM 8h Now 24/03/2016 3:59:39 PM 100%



How PI System Explorer is Used at PowerStream

PI Asset Framework (AF)

- Key Station Equipment and Distribution System Assets
- Outage and Other Event Information

PI AF Elements

- Attributes from PI Tags, CMMS, OMS, CIS, Web pages (HTML) and static data
- Longitude & Latitude (for ESRI Map Reports)
- Attributes used in many PI 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) – PowerStream

Elements

Elements

- Elements
 - Circuit Breaker List
 - PowerStream
 - Feeders
 - Hydro One Stations
 - North Service Area
 - RTUs
 - South Service Area
 - Aurora
 - Markham
 - Richmond Hill
 - Richmond Hill Customer Stations
 - Richmond Hill Transformer Stations
 - RHTS1:Lazenby 1
 - RHTS2:Lazenby 2
 - Circuit Breakers
 - RHTS2:Lazenby 2:36CD
 - RHTS2:Lazenby 2:36M1
 - RHTS2:Lazenby 2:36M10
 - RHTS2:Lazenby 2:36M2
 - RHTS2:Lazenby 2:36M3
 - RHTS2:Lazenby 2:36M4
 - RHTS2:Lazenby 2:36M5
 - RHTS2:Lazenby 2:36M6
 - RHTS2:Lazenby 2:36M7
 - RHTS2:Lazenby 2:36M8
 - RHTS2:Lazenby 2:36M9
 - RHTS2:Lazenby 2:36T3C
 - RHTS2:Lazenby 2:36T4D
 - Transformers
 - RHTS2:Lazenby 2:T3
 - RHTS2:Lazenby 2:T4
 - South Operations Center
 - Vaughan

Element Templates

Library

- PowerStream
 - Categories
 - Analysis Categories
 - Attribute Categories
 - Element Categories
 - Reference Type Categories
 - Table Categories
 - Templates
 - Element Templates
 - 1 Hydrogen
 - Circuit Breakers
 - Circuit BreakersTemplate
 - CS Transformer
 - Customer Station
 - Generic Station
 - MarkhamTemplate
 - MS Transformer
 - MS431:Dufferin:TTemplate
 - MTS2:A.M. Walker:TTemplate
 - Municipal Station
 - Richmond Hill Transformer StationsTemplate
 - RTU
 - SharePoint Template
 - Transformer Station
 - TS Calisto
 - TS Calisto 2
 - TS Calisto 9
 - TS Calisto1
 - TS Cap Bank Breaker
 - TS Circuit Breaker Template
 - TS Secondary Breaker
 - TS SF6 Circuit Breaker
 - TS Tie Bus Breaker
 - TS Transformer
 - VTS3:Loma Jackson:TTemplate
 - Model Templates

Notifications

Notifications

- New
- Secondary Breaker Status: (VTS2:Torstar:T2)
- Secondary Breaker Status: (VTS3:Loma Jackson:T2)
- Secondary Breaker Status: (VTS3:Loma Jackson:T1)
- Secondary Breaker Status: (MTS4:R.M. Fabro:T1)
- Secondary Breaker Status: (RHTS2:Lazenby 2:T3)
- Secondary Breaker Status: (MTS2:A.M. Walker:T2)
- Secondary Breaker Status: (RHTS2:Lazenby 2:T4)
- Secondary Breaker Status: (MTS1:J.V. Fry:T2)
- Secondary Breaker Status: (MTS1:J.V. Fry:T1)
- TRN Loading: MTS1:J.V. Fry:T1 (MTS1:J.V. Fry:T1)
- TRN Loading: MTS1:J.V. Fry:T2 (MTS1:J.V. Fry:T2)
- TRN Loading: MTS2:A.M. WALKER:T1 (MTS2:A.M. Walker:T1)
- TRN Loading: MTS2:A.M. WALKER:T2 (MTS2:A.M. Walker:T2)
- TRN Loading: MTS3:D.H. Cockburn:T1 (MTS3:D.H. Cockburn:T1)
- TRN Loading: MTS3:D.H. Cockburn:T2 (MTS3:D.H. Cockburn:T2)
- TRN Loading: MTS3:E.D.H. Cockburn Expansion:T3 (MTS3:E.D.H.)
- TRN Loading: MTS3:E.D.H. Cockburn Expansion:T4 (MTS3:E.D.H.)
- TRN Loading: MTS4:R.M. Fabro:T1 (MTS4:R.M. Fabro:T1)
- TRN Loading: MTS4:R.M. Fabro:T2 (MTS4:R.M. Fabro:T2)
- TRN Loading: RHTS1:Lazenby 1:T1 (RHTS1:Lazenby 1:T1)
- TRN Loading: RHTS1:Lazenby 1:T2 (RHTS1:Lazenby 1:T2)
- TRN Loading: VTS1:Greenwood:T1 (VTS1:Greenwood:T1)
- TRN Loading: VTS1:Greenwood:T2 (VTS1:Greenwood:T2)
- TRN Loading: VTS1E:Greenwood Expansion:T3 (VTS1E:Greenwo
- TRN Loading: VTS1E:Greenwood Expansion:T4 (VTS1E:Greenwo
- TRN Loading: VTS2:Torstar: T1 (VTS2:Torstar:T1)
- TRN Loading: VTS2:Torstar: T2 (VTS2:Torstar:T2)
- TRN Loading:RHTS2:Lazenby 2:T3 (RHTS2:Lazenby 2:T3)
- TRN Loading:RHTS2:Lazenby 2:T4 (RHTS2:Lazenby 2:T4)
- TRN Loading:VTS3:Loma Jackson:T1 (VTS3:Loma Jackson:T1)
- TRN Loading:VTS3:Loma Jackson:T2 (VTS3:Loma Jackson:T2)
- TS Sump Water Level (MTS4:R.M. Fabro)
- TS Sump Water Level (RHTS2:Lazenby 2)
- TS Sump Water Level (VTS1:Greenwood)

Notification Templates

Library

- PowerStream
 - Categories
 - Analysis Categories
 - Attribute Categories
 - Element Categories
 - Reference Type Categories
 - Table Categories
 - Templates
 - Element Templates
 - Model Templates
 - Notification Templates
 - MS AC Rectifier
 - MS Building Temperature
 - MS Circuit Breaker Operation Status
 - MS High Winding Temperature
 - MS Sump Water Level
 - Primary Switch Status: Calisto 2
 - Primary Switch Status: Calisto
 - Primary Switch Status: Calisto 9
 - Primary Switch Status: TS Transformer
 - RTU Communication Failed
 - RTU Communication Normal
 - RTU Monthly Battery Test Failure
 - Secondary Breaker Status: Calisto
 - Secondary Breaker Status: Calisto 2
 - Secondary Breaker Status: Calisto 9
 - Secondary Breaker Status: TS Transformer
 - SF6 Gas Alarm
 - Transformer Rating: TS Transformer
 - TRN Loading: TS Calisto
 - TRN Loading: TS Calisto 2
 - TRN Loading: TS Calisto 9
 - TRN Loading: TS Transformer
 - TS Circuit Breaker Operation Status
 - TS Sump Water Level

PI Coresight / PI ProcessBook Reports - Powerstream

- 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)
- Adhoc Reports

Real-Time Equipment Reports

PowerStream		PowerStream PI Reports		PowerStream	
System Reports <ul style="list-style-type: none"> System Demand Report <input type="button" value="Open"/> TS Station Performance Report <input type="button" value="Open"/> MS Station Performance Report <input type="button" value="Open"/> UFLS Report <input type="button" value="Open"/> Station Transformer Availability Map <input type="button" value="Open"/> North Station Building Temperatures <input type="button" value="Open"/> Smoke and Fire Report <input type="button" value="Open"/> North Traid Load Report <input type="button" value="Open"/> 		Transformer Reports <ul style="list-style-type: none"> R.M. Fabro Graphical <input type="button" value="Open"/> MS Transformer Report <input type="button" value="Open"/> TS Transformer Report <input type="button" value="Open"/> GIC Monitoring Report <input type="button" value="Open"/> TS Oil Temp Report <input type="button" value="Open"/> Tap Changer Report <input type="button" value="Open"/> Tap Changer Position Report <input type="button" value="Open"/> TS Station Cooling Report <input type="button" value="Open"/> Hydrogen Gas Report <input type="button" value="Open"/> 		Circuit Breaker Reports <ul style="list-style-type: none"> MS Circuit Breaker Report <input type="button" value="Open"/> TS Circuit Breaker Report <input type="button" value="Open"/> MS Detailed Circuit Breaker Report <input type="button" value="Open"/> TS Detailed Circuit Breaker Report <input type="button" value="Open"/> SF6 Report <input type="button" value="Open"/> 	
Single Line Diagrams <ul style="list-style-type: none"> MTS4: R.M. Fabro <input type="button" value="Open"/> MTS1: J.V. Fry <input type="button" value="Open"/> MTS2: A.M. Walker <input type="button" value="Open"/> MTS3: D.H. Cockburn <input type="button" value="Open"/> MTS3E: D.H. Cockburn Expansion <input type="button" value="Open"/> VTS1: Greenwood <input type="button" value="Open"/> 		Switch Reports <ul style="list-style-type: none"> Primary Switch Report <input type="button" value="Open"/> 		DGA Reports <ul style="list-style-type: none"> MS DGA Report <input type="button" value="Open"/> TS DGA Report <input type="button" value="Open"/> 	
230kV & 44kV System Diagrams <ul style="list-style-type: none"> South 230 kV Layout <input type="button" value="Open"/> North 230 kV & 115 kV Layout <input type="button" value="Open"/> 44 kV Penetanguishene <input type="button" value="Open"/> 44 kV Alliston, Tottenham, Beeton <input type="button" value="Open"/> 44 kV System Bradford <input type="button" value="Open"/> 		DC Systems Reports <ul style="list-style-type: none"> North DC Systems <input type="button" value="Open"/> South DC Systems <input type="button" value="Open"/> 		Bushing Monitor Reports <ul style="list-style-type: none"> Combined <input type="button" value="Open"/> 	
		CHR Reports <ul style="list-style-type: none"> TS Transformers <input type="button" value="Open"/> 		Distribution Automation Scheme Report <ul style="list-style-type: none"> DAS Report <input type="button" value="Open"/> 	
				Capacitor Room Report <ul style="list-style-type: none"> VTS3:Jackson TS Capacitor Monitor Room Report <input type="button" value="Open"/> 	



TS Transformer Report – PI ProcessBook

Links:

- Weather report
- Radar Map Link

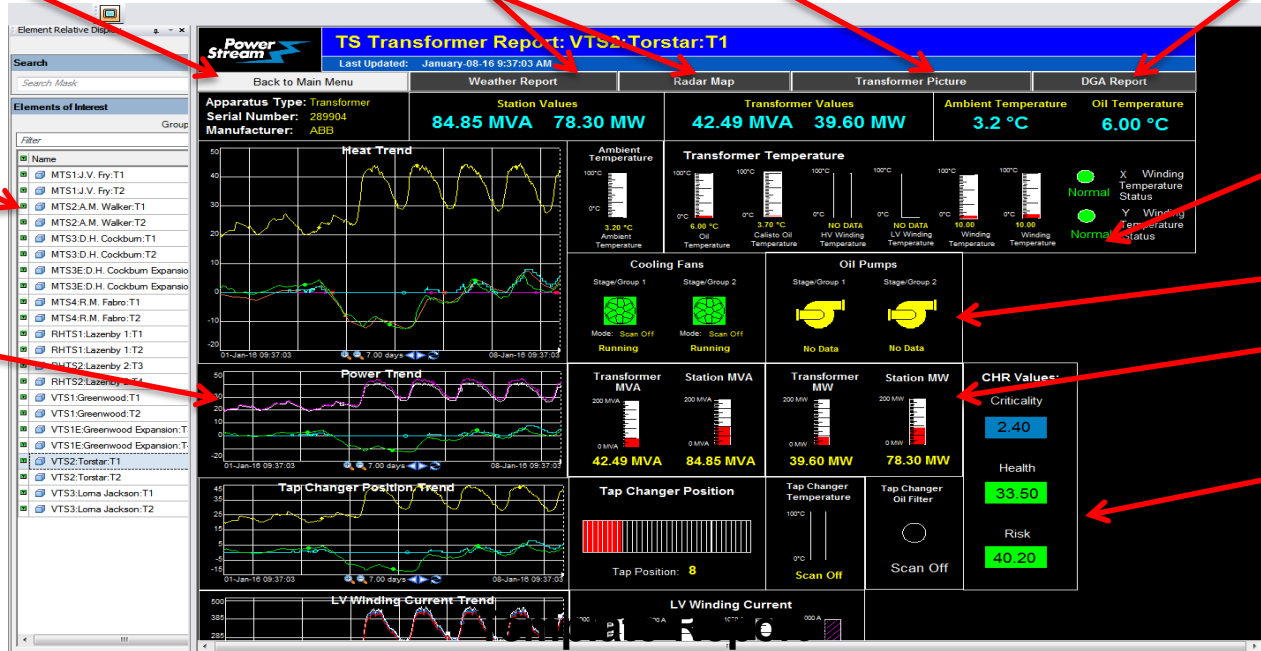
Pictures

External Database/App

Equipment Attributes

AF Elements

Trends



Status

Animations

Gauges

Heath and Risk Index



230kV Transmission Supply Status Report

PI Coresight

230kV Layout v3(Coresight version)

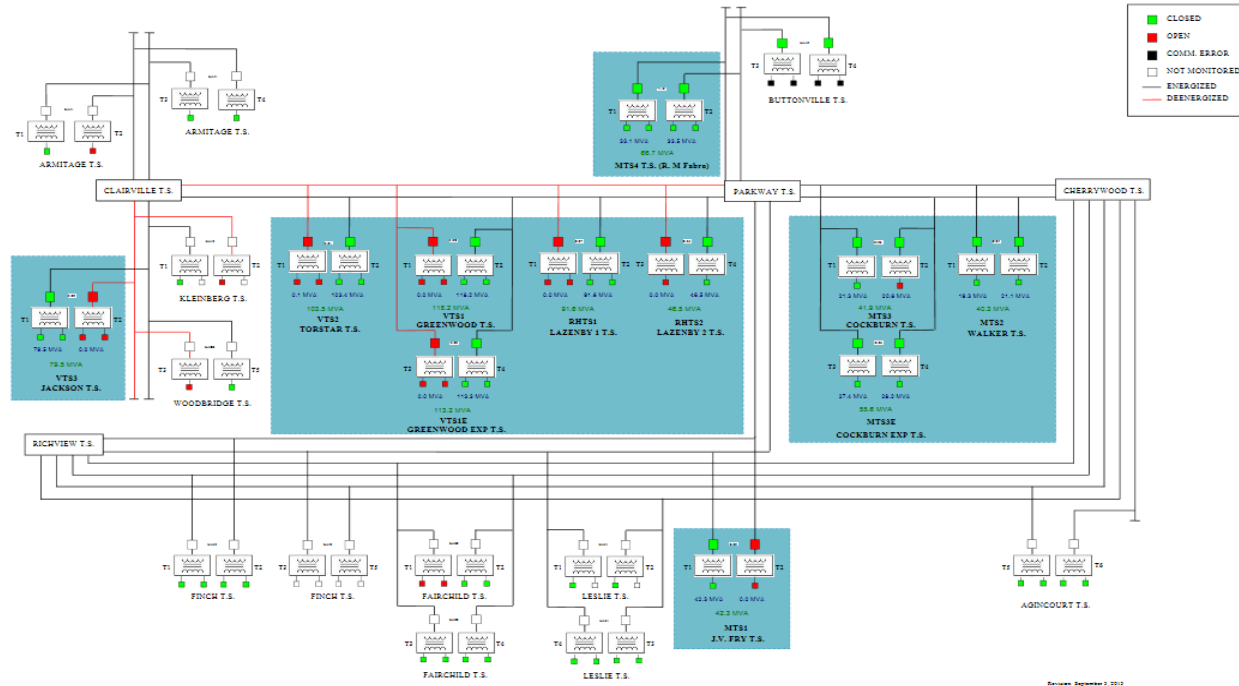
Ad Hoc Display



230 kV Transmission Lines Layout

System Load **1172.0 MW**

Overall TS Station Risk Index **73.9308 %** Overall TS Transformer Availability **68.1818 %**



22/09/2015 7:44:58 AM

8h

Now

22/09/2015 3:44:58 PM

100%



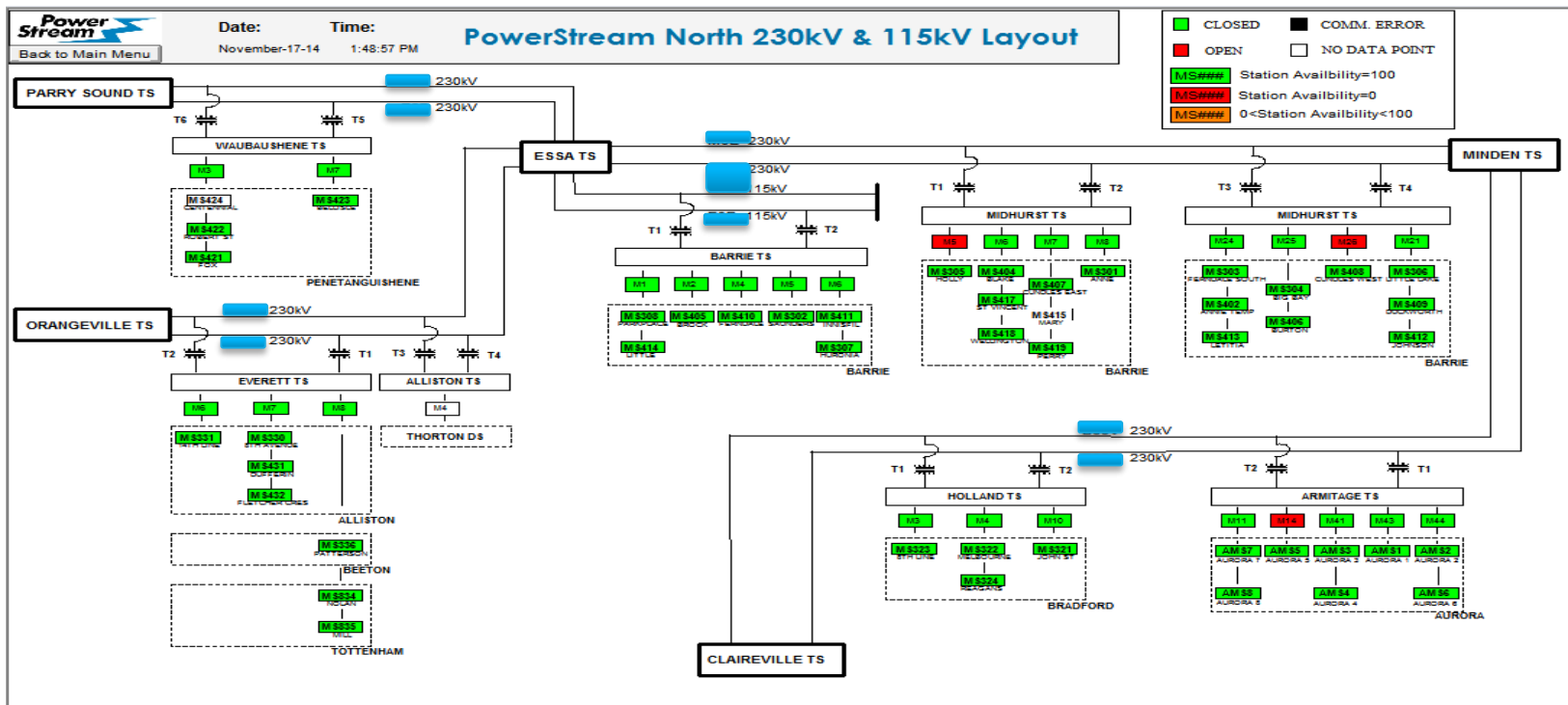
OSIsoft

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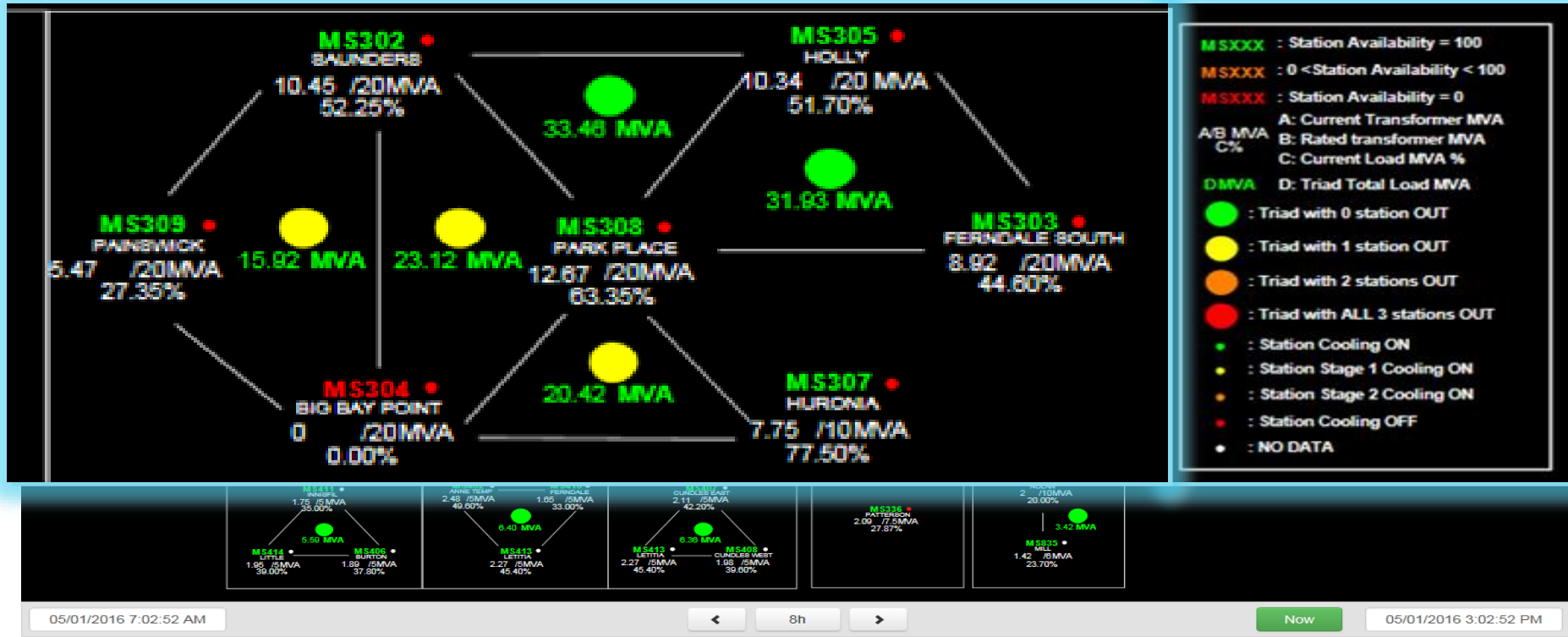
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Reports – Transmission System Supply - North



Substation Interconnection – Load Transfer Report



Station Performance Metrics (Example)

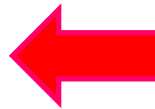
Overall TS Station Performance	
Overall TS Station Risk Index	79.61 %
Overall TS Transformer Availability	72.7273 %
Overall TS Bus Availability	100 %
Feeder TS Breakers "Closed"	92.36 %


Performance Indicators
 (Performance Equations)

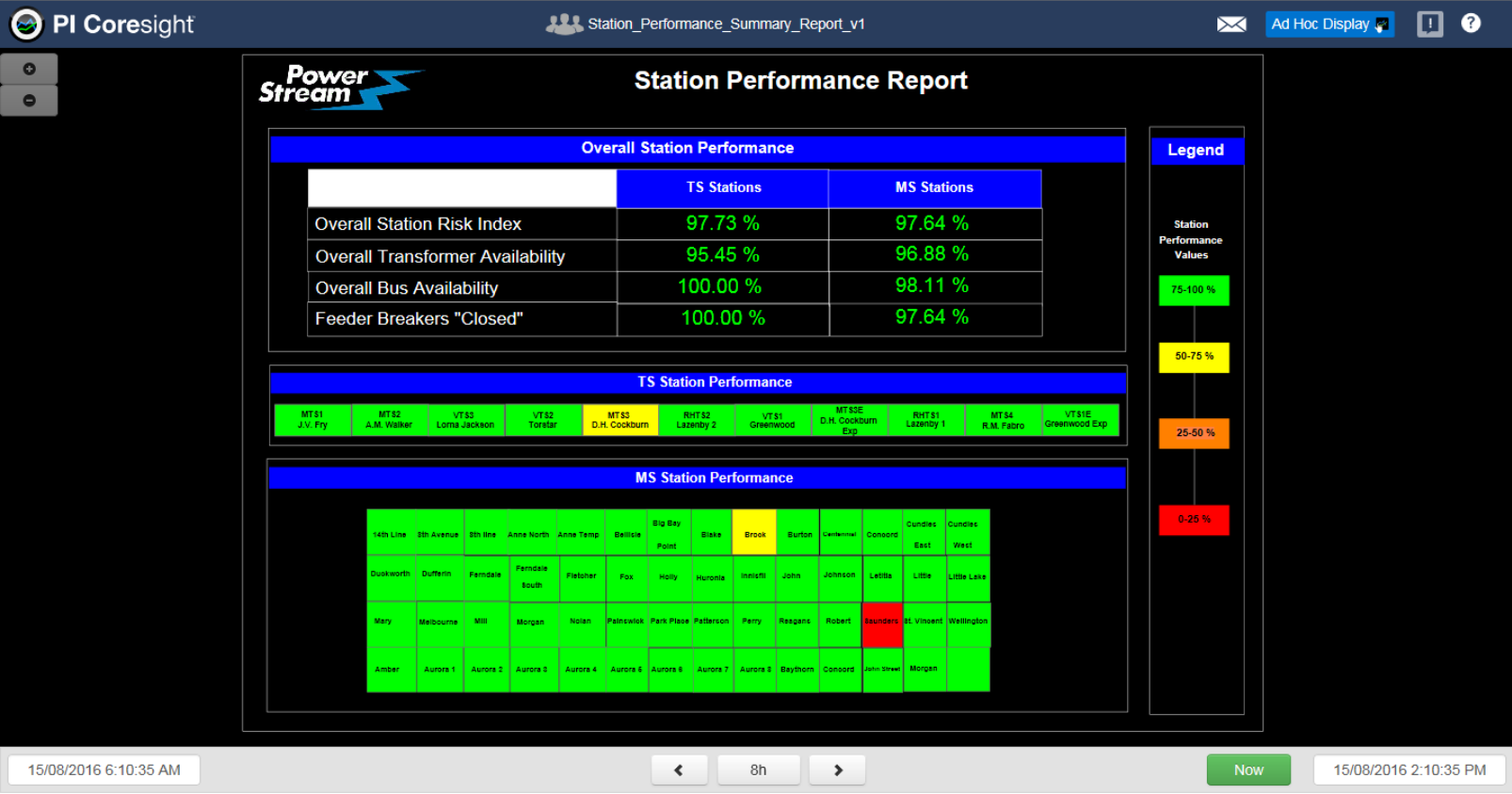
MTS3:D.H. Cockburn	
Station Status	On
Station Risk Index	100
Transformer Availability	100
Bus Availability	100
Bus E Availability	LIVE
Bus E Voltage	28.65
Bus Z Availability	LIVE
Bus Z Voltage	28.67
Feeder Breakers Closed (%)	100
RHTS2:Lazenby 2	
Station Status	On
Station Risk Index	65.625
Transformer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


Substation Availability (Risk) Report



Feeder Availability Report – Risk

PI Alert: An update on AMS1:Aurora 1:F4 Performance - Message (HTML)

FileMessageTell me what you want to do...



PI-Notifications | Vince Polsoni

Thu 9:32 AM

PI Alert: An update on AMS1:Aurora 1:F4 Performance

Update:

Time: 01/09/2016 09:32:07

Feeder	Incidents in Last 30 Days	Incidents in Last 60 Days	Incidents in Last 90 Days	Incidents YTD	Customer Count
AMS1:Aurora 1:F4	1	3	5	7	458

For more information please see [Operations on DPDs \(MS Feeders\)](#)

Thank you,
Station Sustainment Department
PowerStream Inc.

15/08/2016 6:15:21 AM

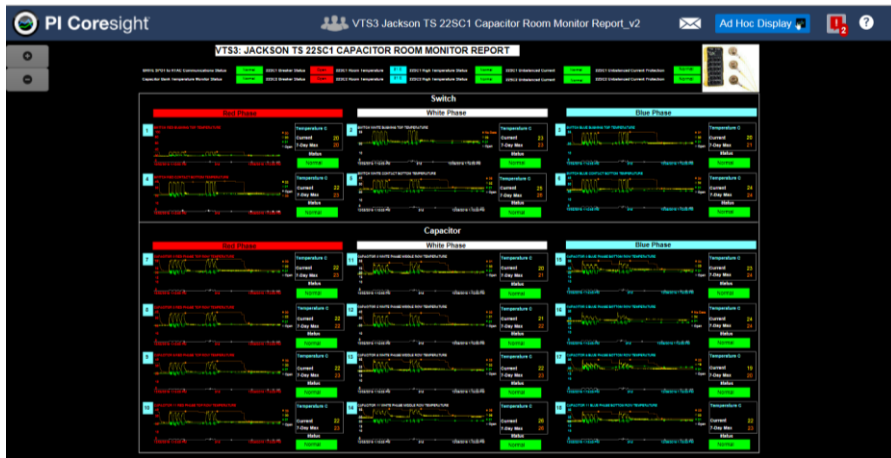
<8h>

Now

15/08/2016 2:15:21 PM

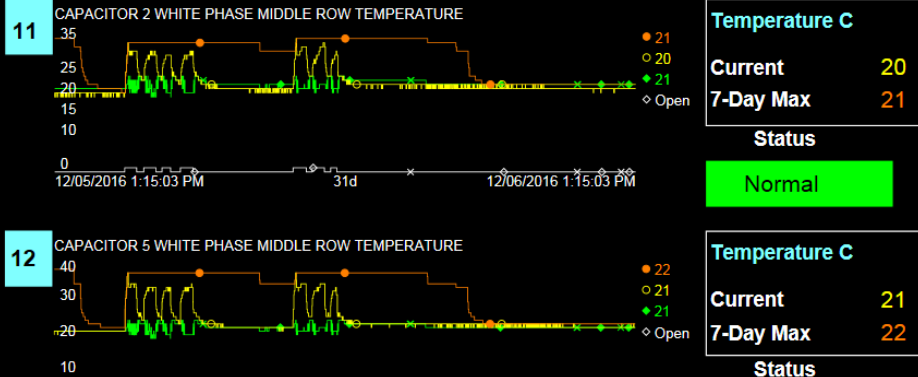


Temperature Sensor Monitoring



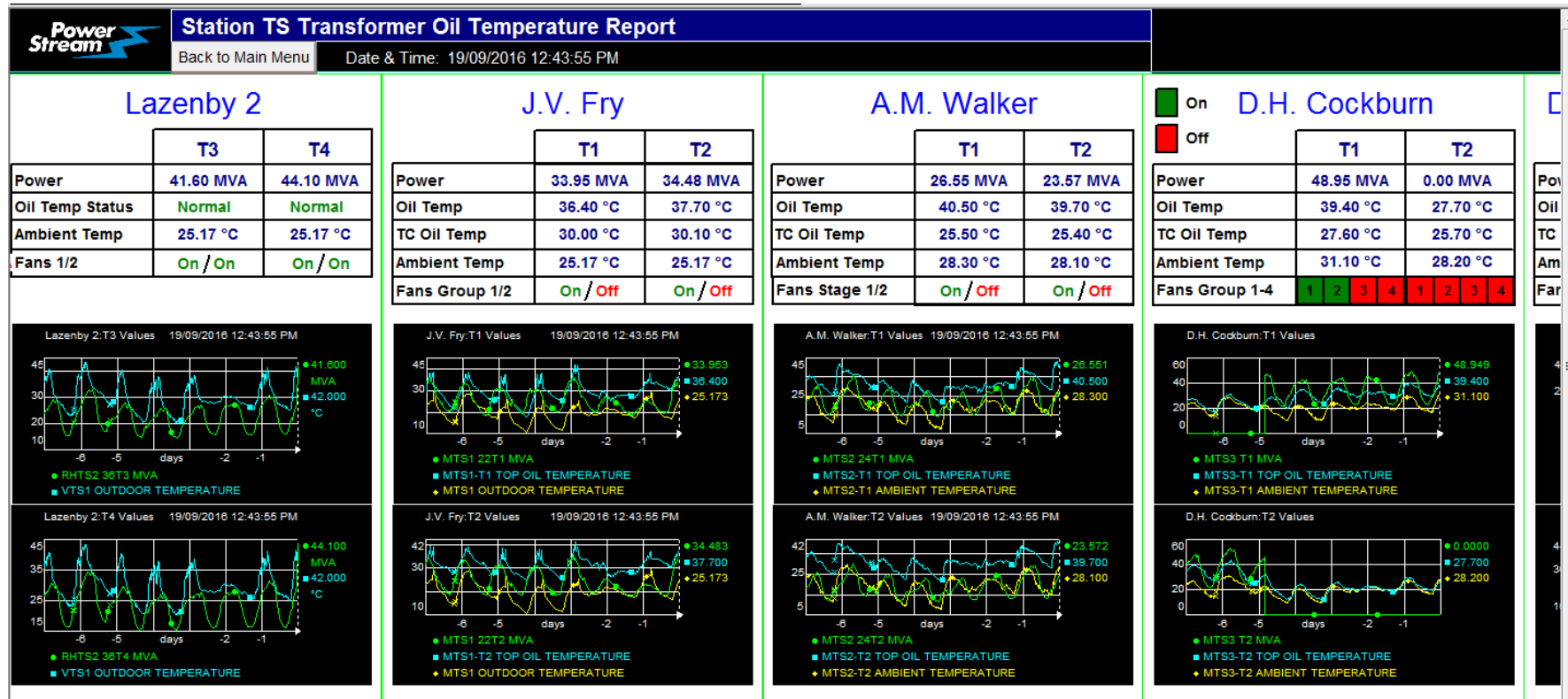
Capacitor

White Phase



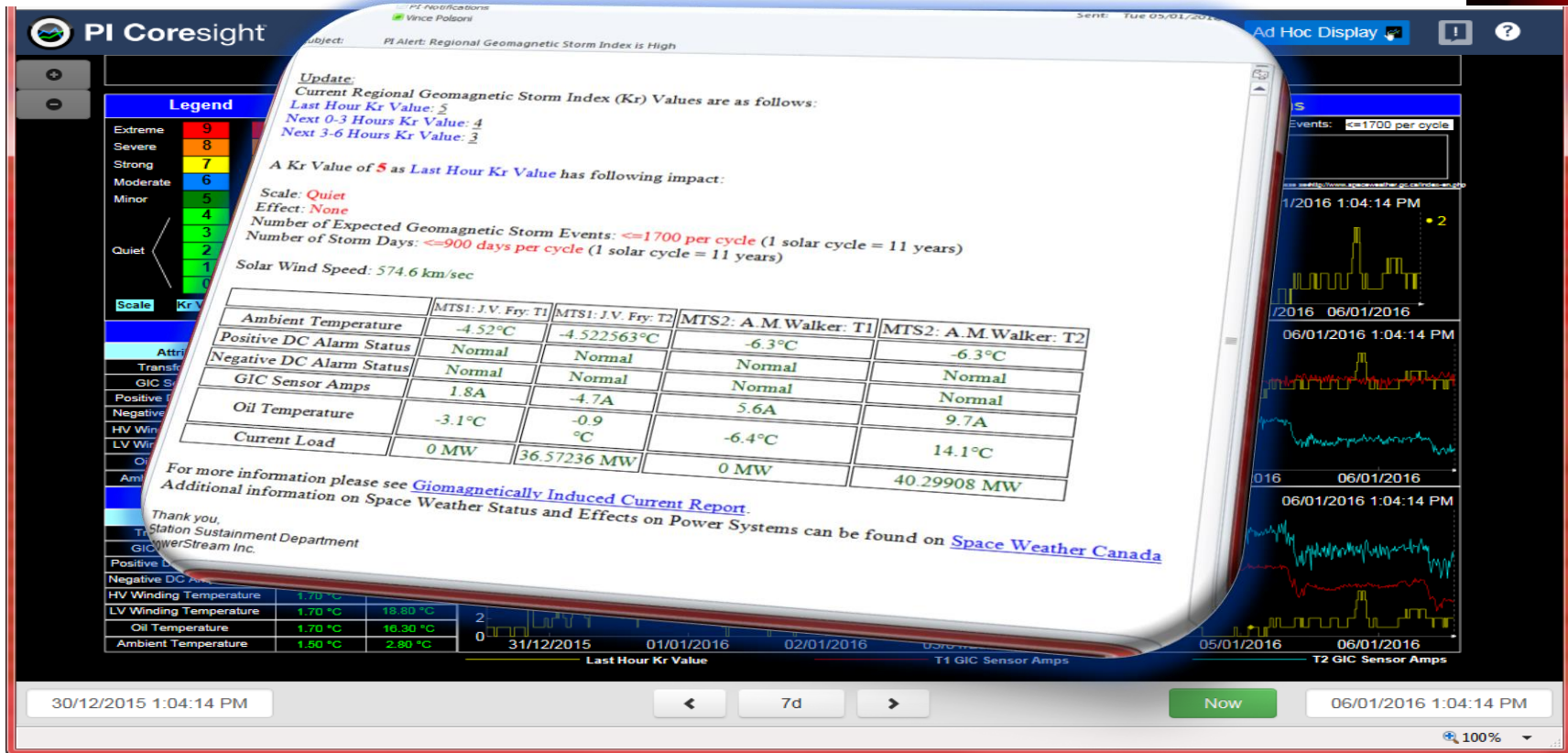
- Monitors temperature of Switch Contacts, Switch Bushings, Individual Capacitors and Room

Station Transformer Oil Temperature Report





Geomagnetically Induced Current Report



Station Building Temperature Report

PI Coresight

PI Alert: MS322:Melbourne Building T...

Ad Hoc Display

Power Stream

PI-Notifications | Vince Polsoni | 06/09/2016

PI Alert: MS322:Melbourne Building Temperature

This message was sent with High importance.

Location: MS322:Melbourne
Time: 06/09/2016 14:52:09
Triggering Condition: Building Temperature ≥ 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.

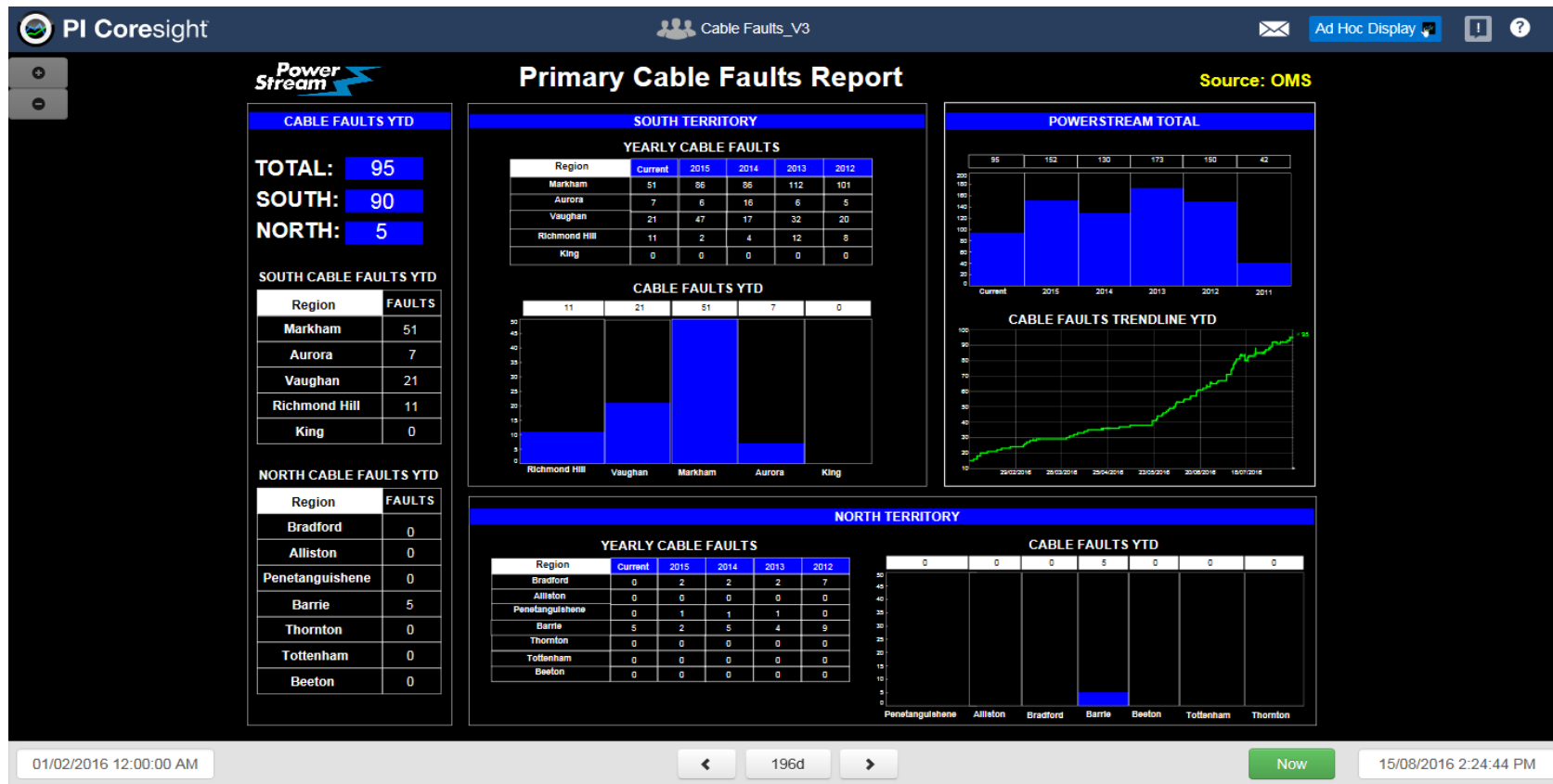
Station	Temperature	Humidity	Wind Speed	Wind Direction
MS320: 8th	29	35	13 kmph	SSE
MS331: 14th	26	26		
MS331: 14th	29	35		
MS431: 1st	27	33		
MS431: 1st	21	29		
MS431: 1st	22	27		
MS431: 1st	23	36		
MS431: 1st	21	27		
MS431: 1st	25	30		
MS431: 1st	23	34		
MS431: 1st	25	32		
MS431: 1st	24	29		
MS431: 1st	23	28		
MS431: 1st	20	37		
MS431: 1st	28	33		
MS431: 1st	17	37		
MS431: 1st	28	31		
MS431: 1st	25	32		
MS431: 1st	27	30		
MS431: 1st	25	31		
MS431: 1st	25	33		
MS431: 1st	15	36		
MS431: 1st	22	27		
MS431: 1st	27	32		
MS431: 1st	28	31		
MS431: 1st	22	29		

Station	Temperature	Humidity	Wind Speed	Wind Direction
MS421: Fox	34 °C	27	13 kmph	S
MS422: Robert	33 °C	27		
MS423: Bellisle	33 °C	22		

Station	Temperature	Humidity	Wind Speed	Wind Direction
MS421: Fox	34 °C	27	13 kmph	S
MS422: Robert	33 °C	27		
MS423: Bellisle	33 °C	22		



Primary Cable Fault Report



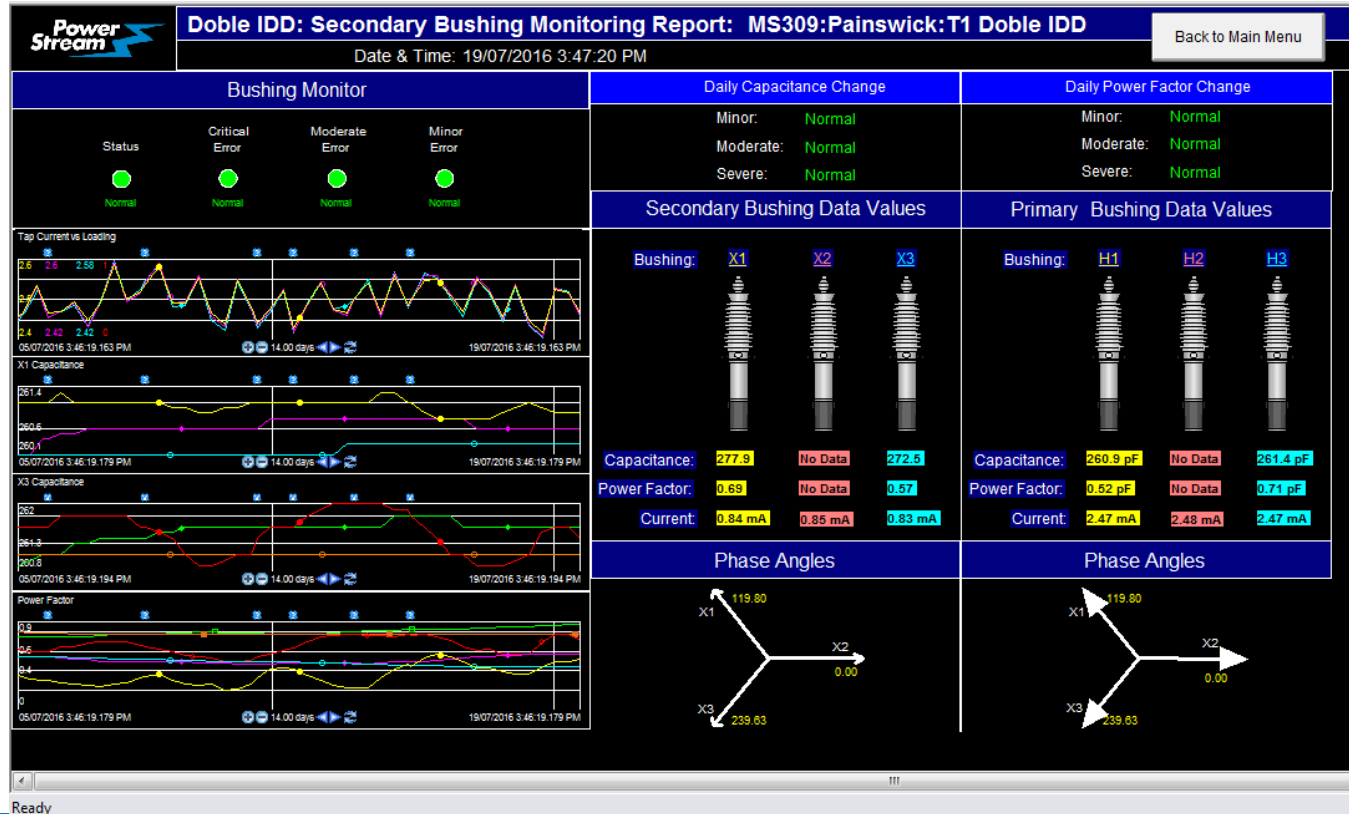
OSIsoft.

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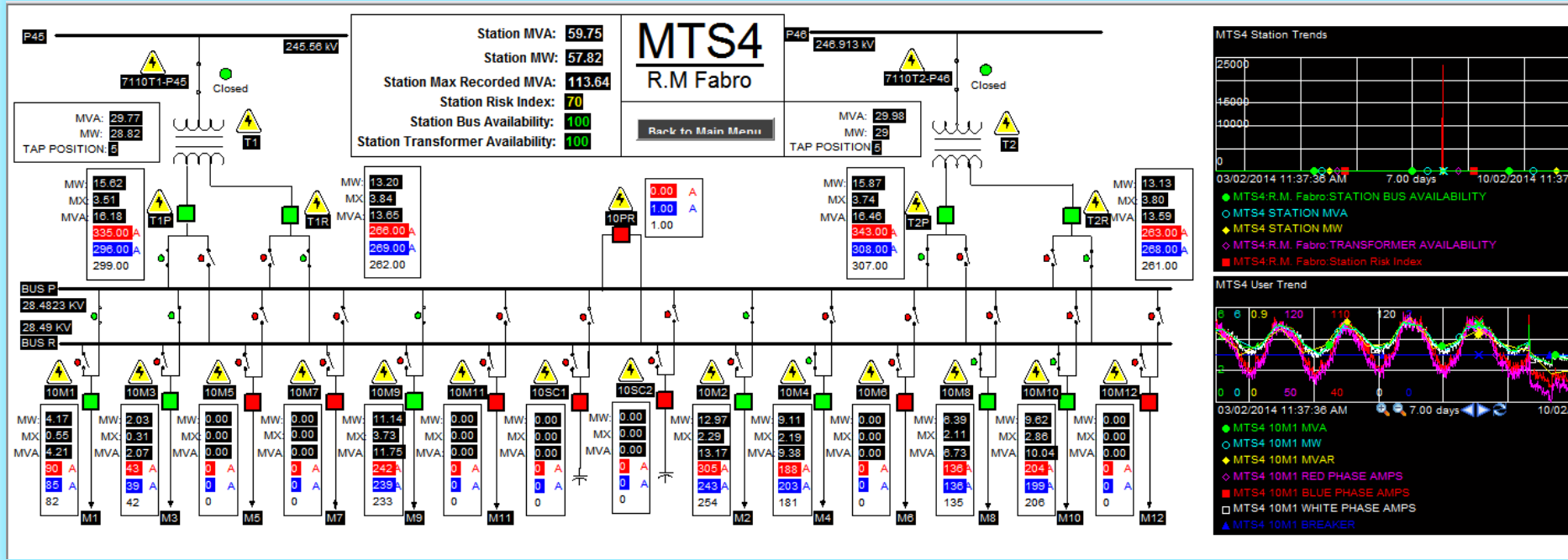
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Transformer Online Bushing Report

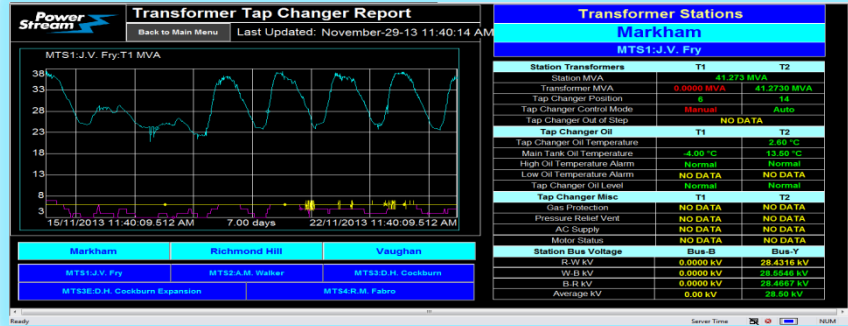


PI ProcessBook – Station Single Line

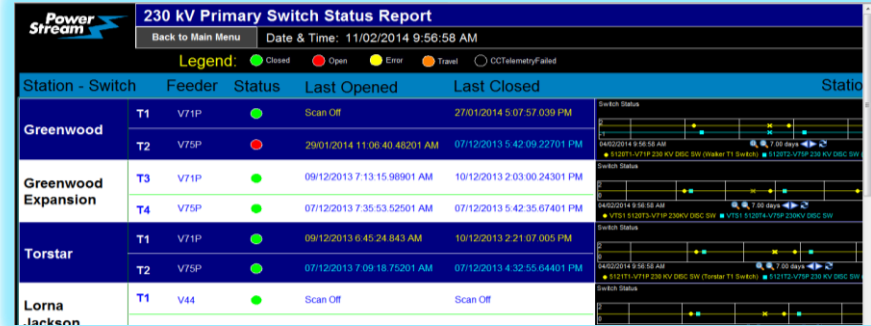


PI ProcessBook Reports

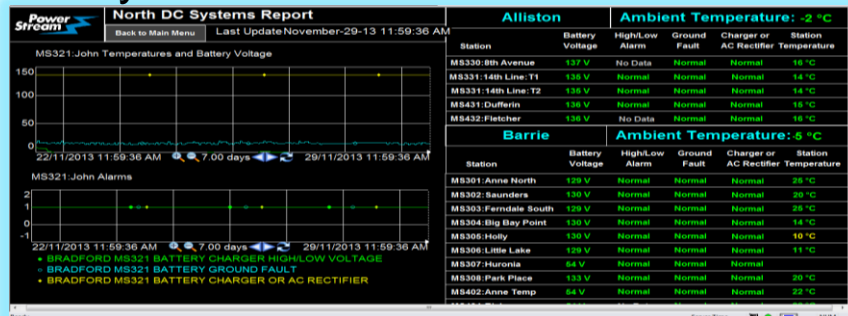
Tap Changer



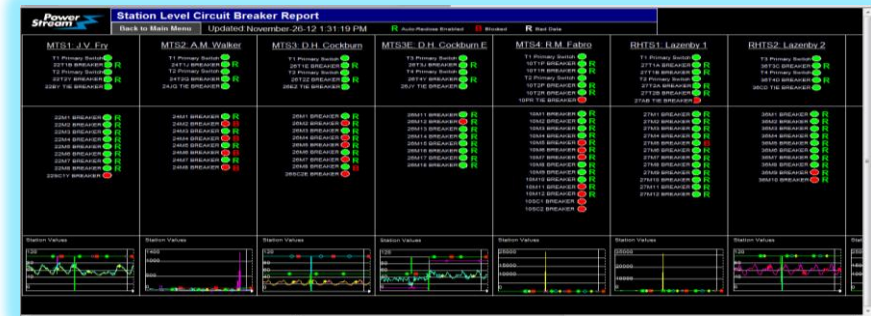
230 kV Primary Switch Status



DC Systems



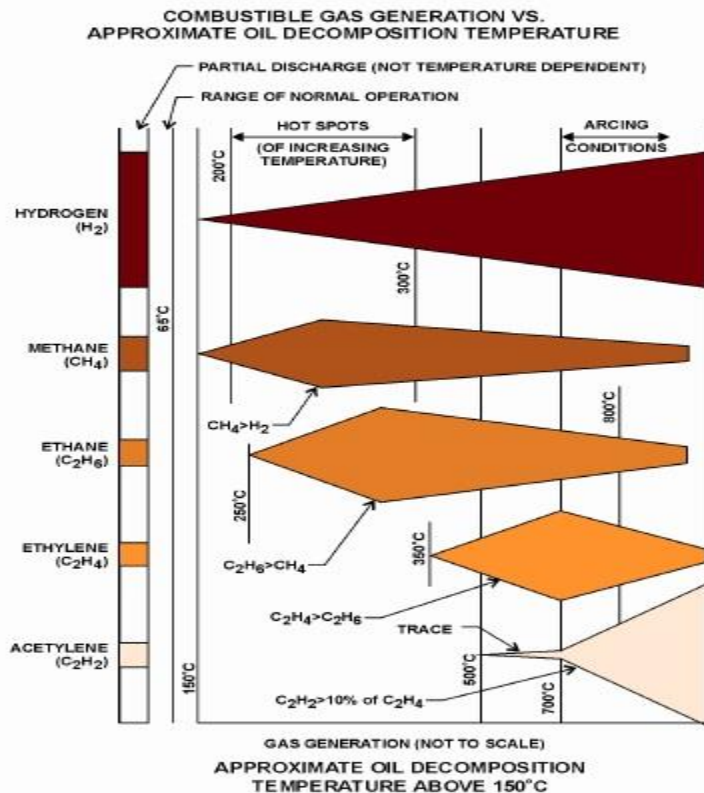
Circuit Breaker Status



Substation Transformer Hydrogen Gas Alarm Report

Anne North MS301: T1	Saunders MS302: T1
Normal	
Little Lake MS306: T1	Huronia MS307: T1
Normal	Normal
Melbourne MS322: T1	8th Line MS323: T1
	Normal
14th Line MS331: T2	Patterson MS336: T1
Normal	Normal
Burton MS406: T1	Cundles East MS407: T1
Normal	
Innisfil MS411: T1	Johnson MS412: T1
Normal	
St Vincent MS417: T1	Wellington MS418: T1
Bellisle MS423: T1	Centennial MS424: T1
	Normal

19/07/2016 7:43:12 AM

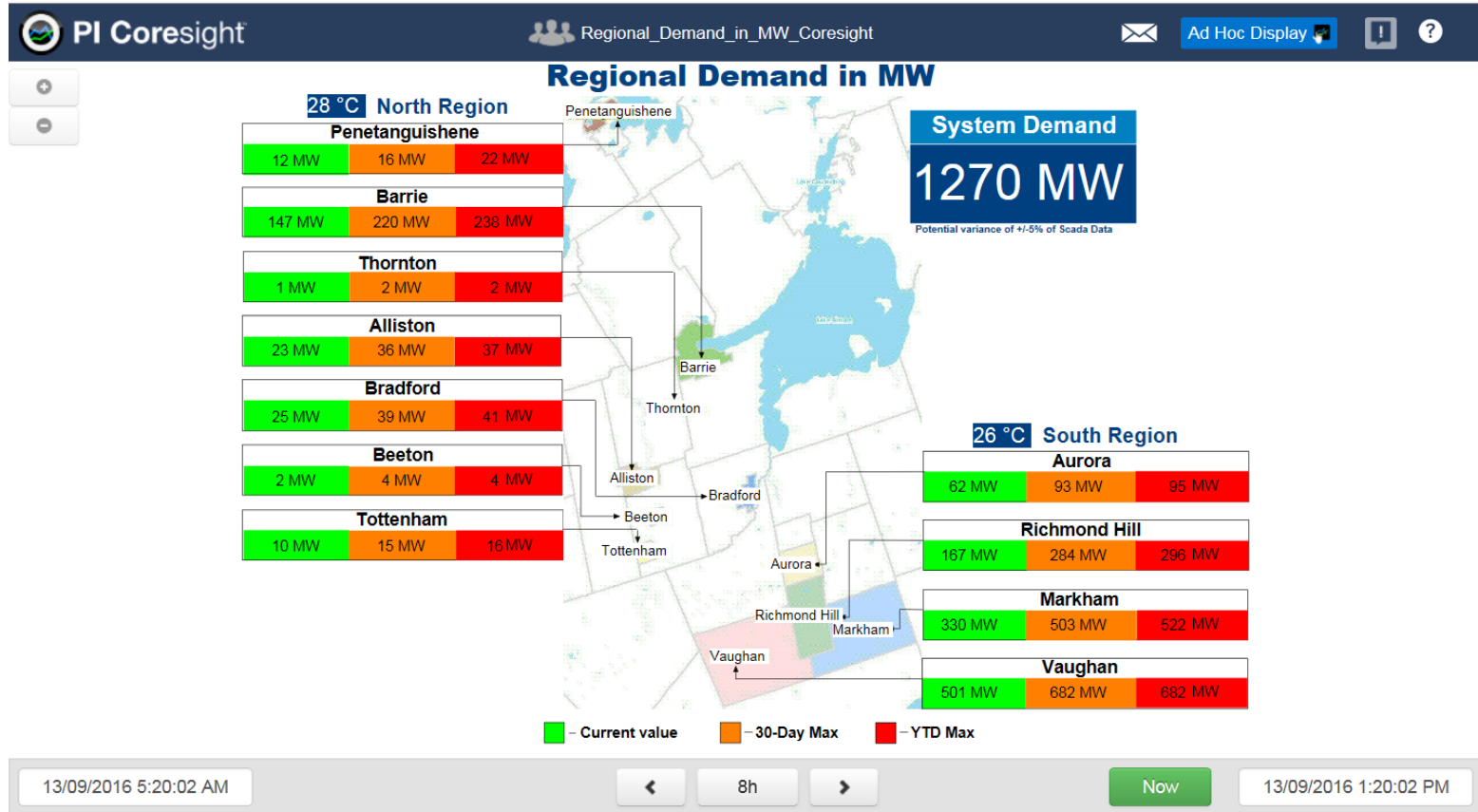


SOUTH

Amber Amber: T2	Intellix GLA 100
Normal	
Aurora 1 AMS1: T2	
Normal	
Aurora 3 AMS3: T1	
Aurora 4 AMS4: T1	Aurora 4 AMS4: T2
Normal	Normal
Aurora 5 AMS5: T2	Aurora 6 AMS6: T1
Normal	Normal
Aurora 7 AMS7: T1	Aurora 8 AMS8: T1
Baythorn Baythorn: T2	John Street John: T1
Morgan Morgan: T1	Morgan Morgan: T2

Now
19/07/2016 3:43:12 PM

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



System Reliability Report using PI Coresight / PI ProcessBook

System Performance

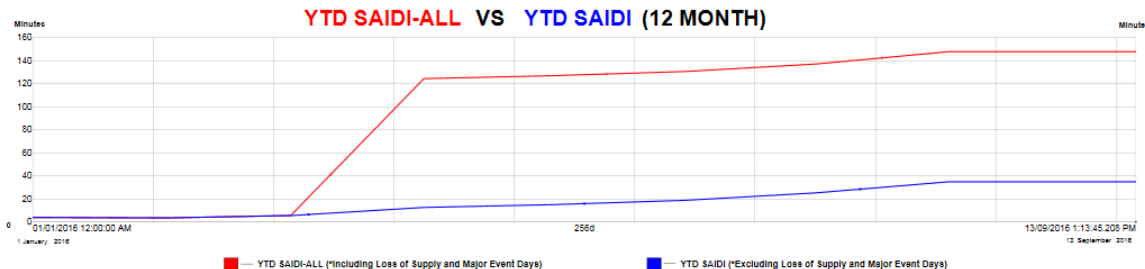


Current Year to Date Index of Reliability = 99.993% (percentage of time power is available)

Average outage duration a PowerStream Customer would experience is 66.89 min (CAIDI)

Statistics	Year End Projection
YTD SAIDI-ALL 148 min YTD SAIFI-ALL 1.00 Interruptions per Customer <small>*Including Loss of Supply and Major Event Days</small>	Current Year SAIDI Target: 68.02 min Current Year End SAIDI Projection: Model 1: 59.71 min Model 2: 61.71 min

Values are from Start of 2016 up to Jul 31, 2016



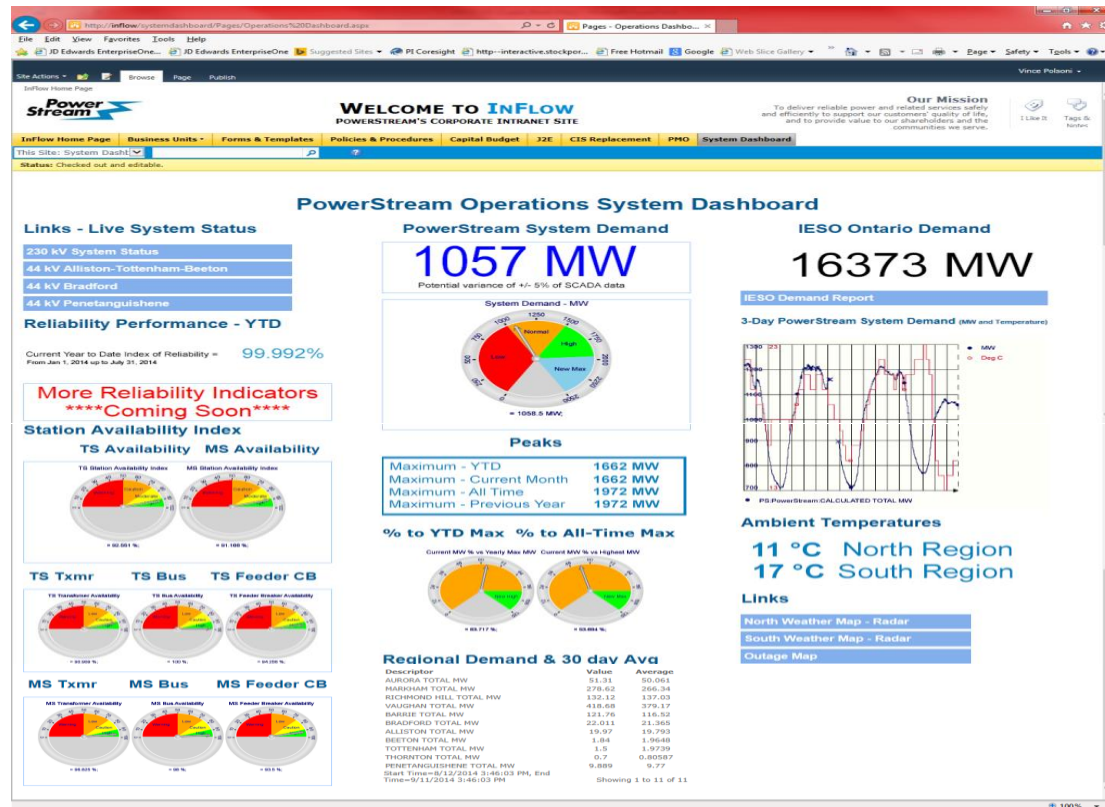
Corporate / Operations Dashboards



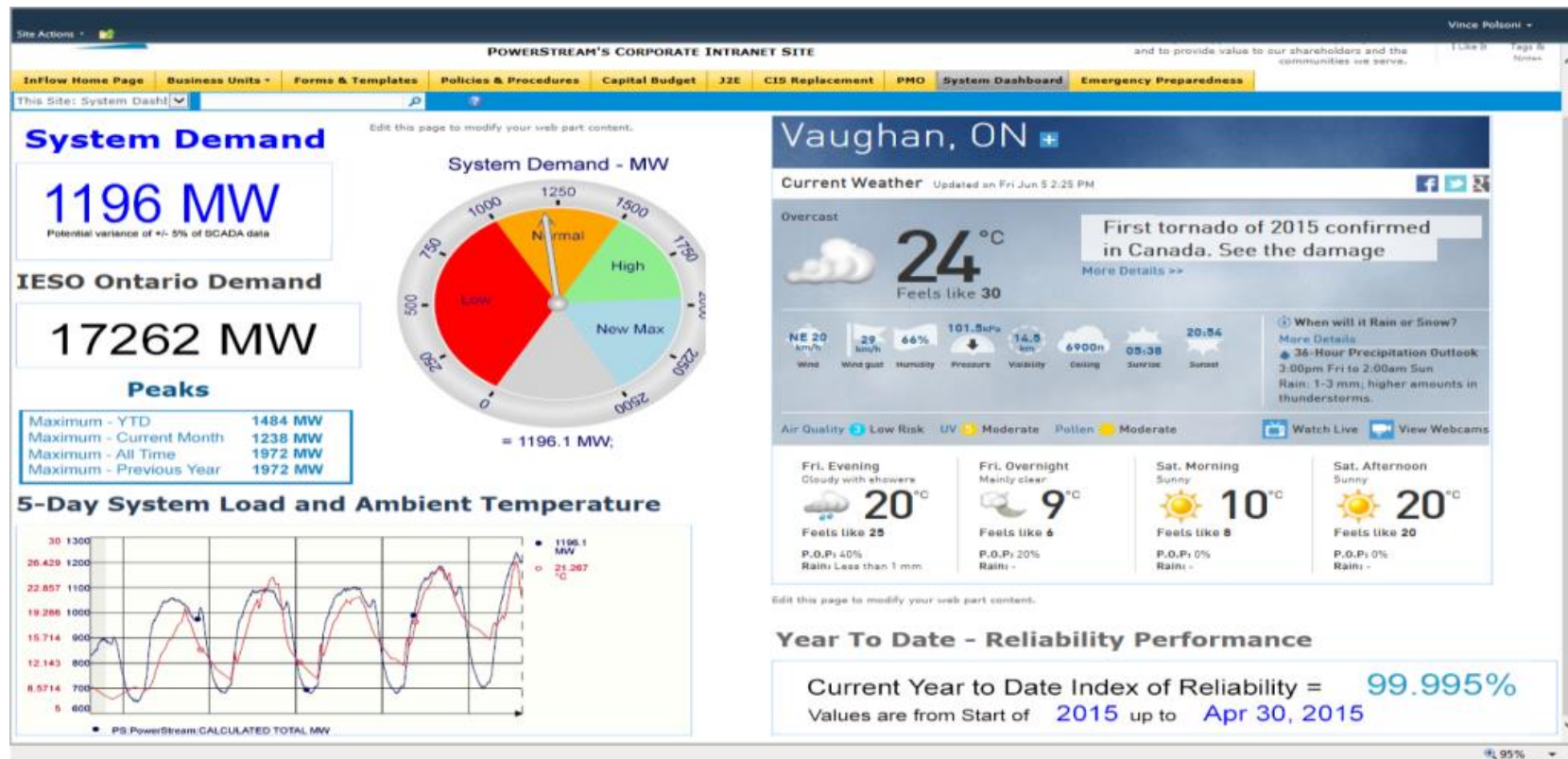
PITV – Public Area



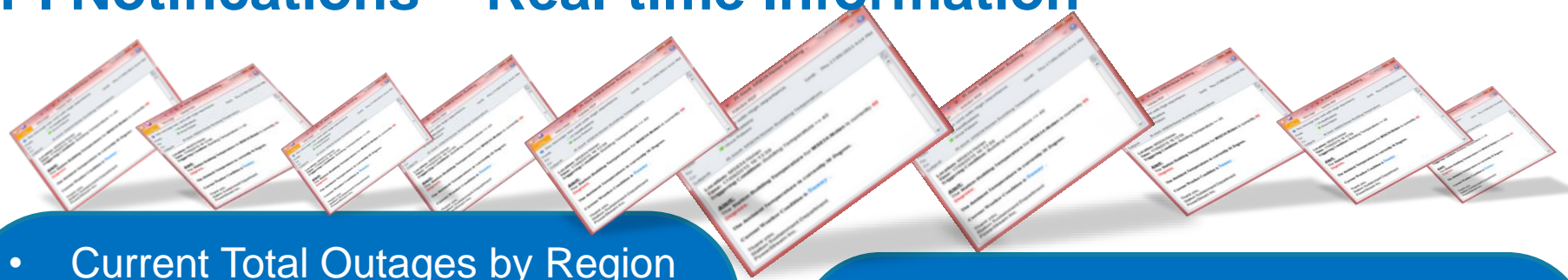
PITV – Office



System Loading Dashboard



PI Notifications – Real-time Information

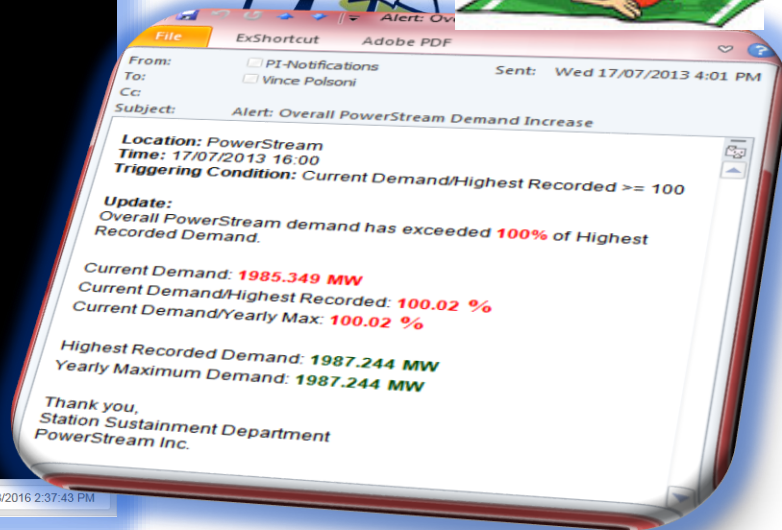
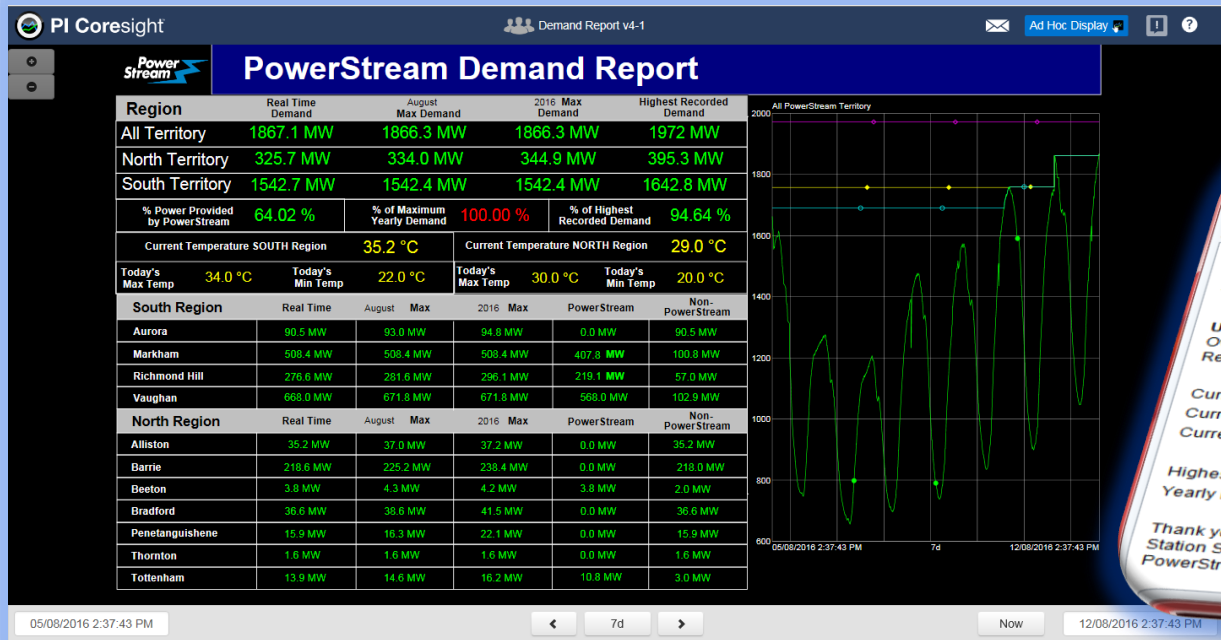


- Current Total Outages by Region
- Circuit Breaker Operation
- Low SF6 Gas
- Station Building Temp
- DC System
- Battery Low Voltage
- Calisto 9 General Alarm
- System Demand

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

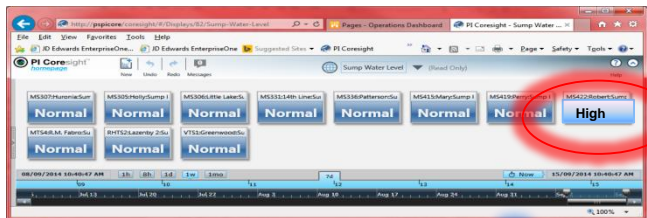
System Demand Report

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



SCADA – PI System – CMMS Working as One

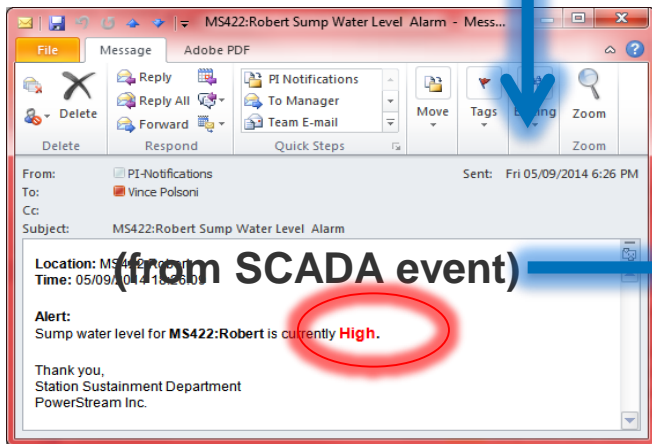
PI Report (High Water Alarm)



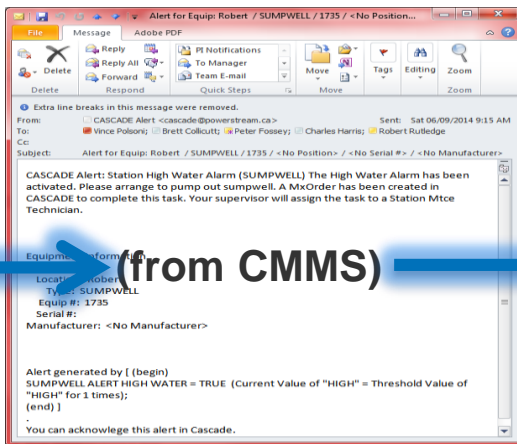
PI Report (High Water Alarm Cleared)



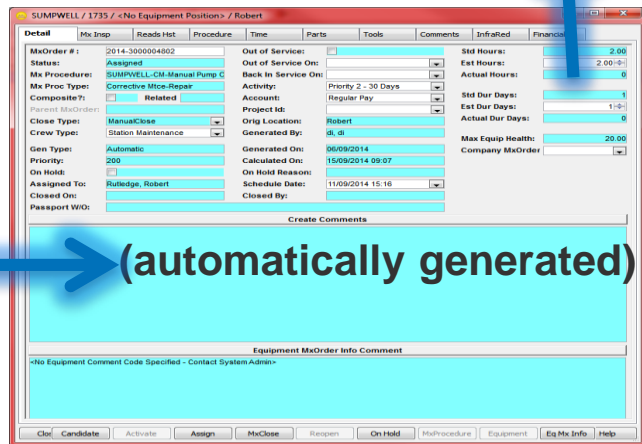
PI Notification



CMMS Alert



CMMS Work Order



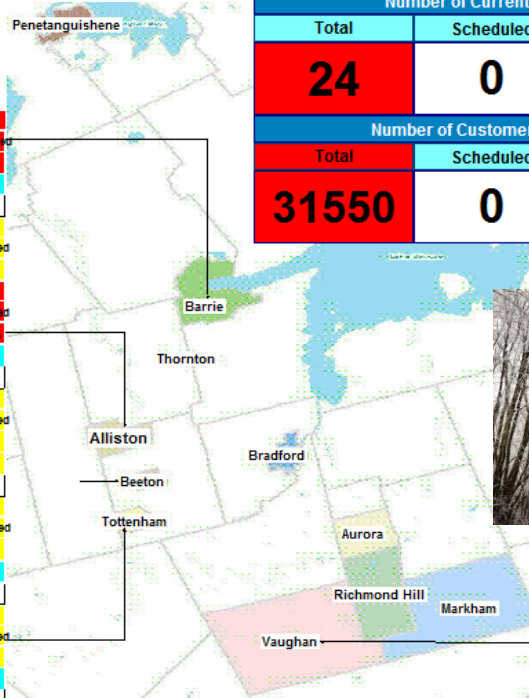
(from SCADA event)

(from CMMS)

(automatically generated)

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	

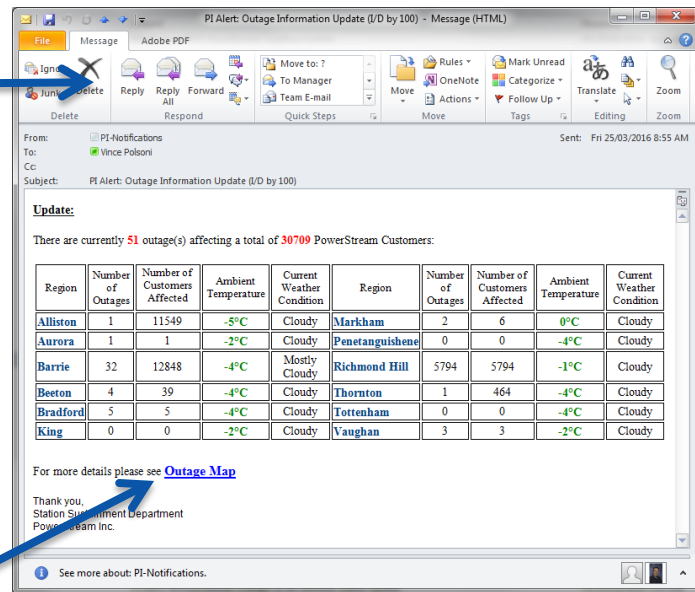
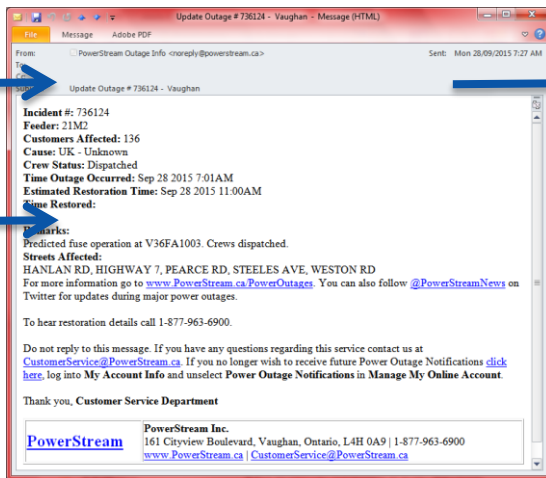
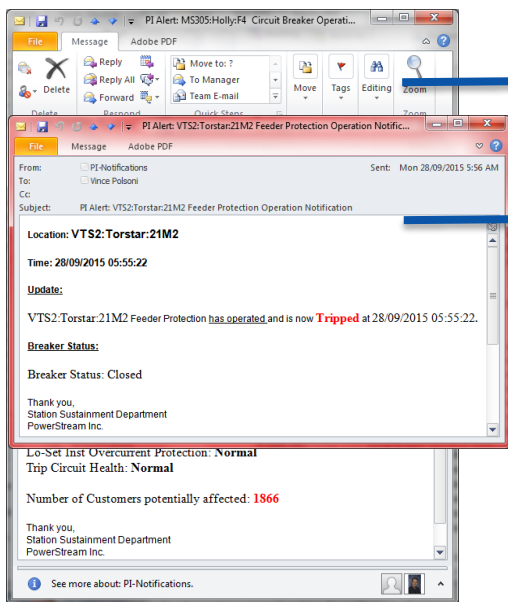
Outage Information Flow with PI System



PI Notifications -
Feeder Protection Trip
& Circuit Breaker Operation

Email - Outage
Management System

PI Notification
Outage Counts by Region



Link to view PI Coresight Report

Feeder Outage Performance Notification



PI Alert: An update on AMS1:Aurora 1:F4 Performance - Message (HTML)

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

PI-Notifications Vince Polsoni Thu 9:32 AM

PI Alert: An update on AMS1:Aurora 1:F4 Performance

Update:

Time: 01/09/2016 09:32:07

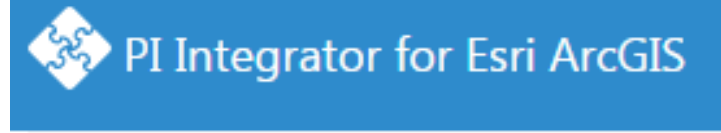
Feeder	Incidents in Last 30 Days	Incidents in Last 60 Days	Incidents in Last 90 Days	Incidents YTD	Customer Count
AMS1:Aurora 1:F4	1	3	5	7	458

For more information please see [Operations on DPDs \(MS Feeders\)](#)

Thank you,
Station Sustainment Department
PowerStream Inc.

Expanded Use of PI System at PowerStream

- Corporate and Operations Dashboards
- PI Integrator for ESRI ArcGIS
- Event Frames
- Asset Analytics
- CMMS - Work Force Performance / Failure Reporting
- Micro Grid Reporting
 - 2 Micro Grid installations
- Merger (PI System expansion)



Exploring Event Frames – PowerStream

- Exploring PI Event Frames
 - Utilizing PI DataLink 2016
- Challenging in the beginning
 - Great Support from OSIsoft
- Utilizing templates in PI AF
- Auto updating of Event Frame reports/charts for Dashboards



230kV Primary Switch Performance Report



PI Coresight		Primary Switch Report		Ad Hoc Display			
Power Stream		230 kV Primary Switch Status		Legend:		CCTelemetryFailed	
Return to Main Menu		230 kV Primary Switch Status		Date and Time: 15/09/2016 3:58			
VAUGHAN		VAUGHAN		VTS3: Lorna Jacks			
VTS1: Greenwood		VTS1: Greenwood		VTS2: 1		VTS3: 2	
Status:		T1 V71P Closed		T2 V75P Closed		T1 V44 Open	
Last Opened:		13-Mar-16 08:42:29		20-Aug-16 09:55:56		10-Sep-16 06:31:11	
Last Closed:		23-Mar-16 18:30:41		20-Aug-16 16:17:40		19-Jun-16 13:39:11	
Days Since Operation:		176		26		5	
Criticality:		1.61		26		1.78	
Health:		64.9		1.61		90.5	
YTD Average:		64.8667		70.1		90.4267	
Risk:		104.49		70.0467		161.09	
YTD Average:		104.437		112.86		160.958	
# of Open Work Orders:		2		3		3	
MARKHAM							
MTS1: J.V. Fry							
Status:		T1 P21R Closed		T2 P21R Closed		T1 P21R Closed	
Last Opened:		6-Sep-16 09:27:14		9-Sep-16 07:47:37		10-Sep-16 16:11:11	
Last Closed:		6-Sep-16 15:52:32		10-Sep-16 16:11:11			
Days Since Operation:		5		5		5	
Criticality:		1.2		1.2		1.2	
Health:		76		76		76	
YTD Average:		126.7		126.7		126.7	
Risk:		133.5		133.5		133.5	
YTD Average:		133.39		133.39		133.39	
# of Open Work Orders:		2		2		3	



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230kV Primary Switch Open-Close Report (PI Event Frames)



TS Primary Switch Operation (Autosaved).xlsx - Excel

File Home Insert Page Layout Formulas Data Review View Data Links PI Builder Power Pivot Tell me what you want to do... Vince Polsoni Share

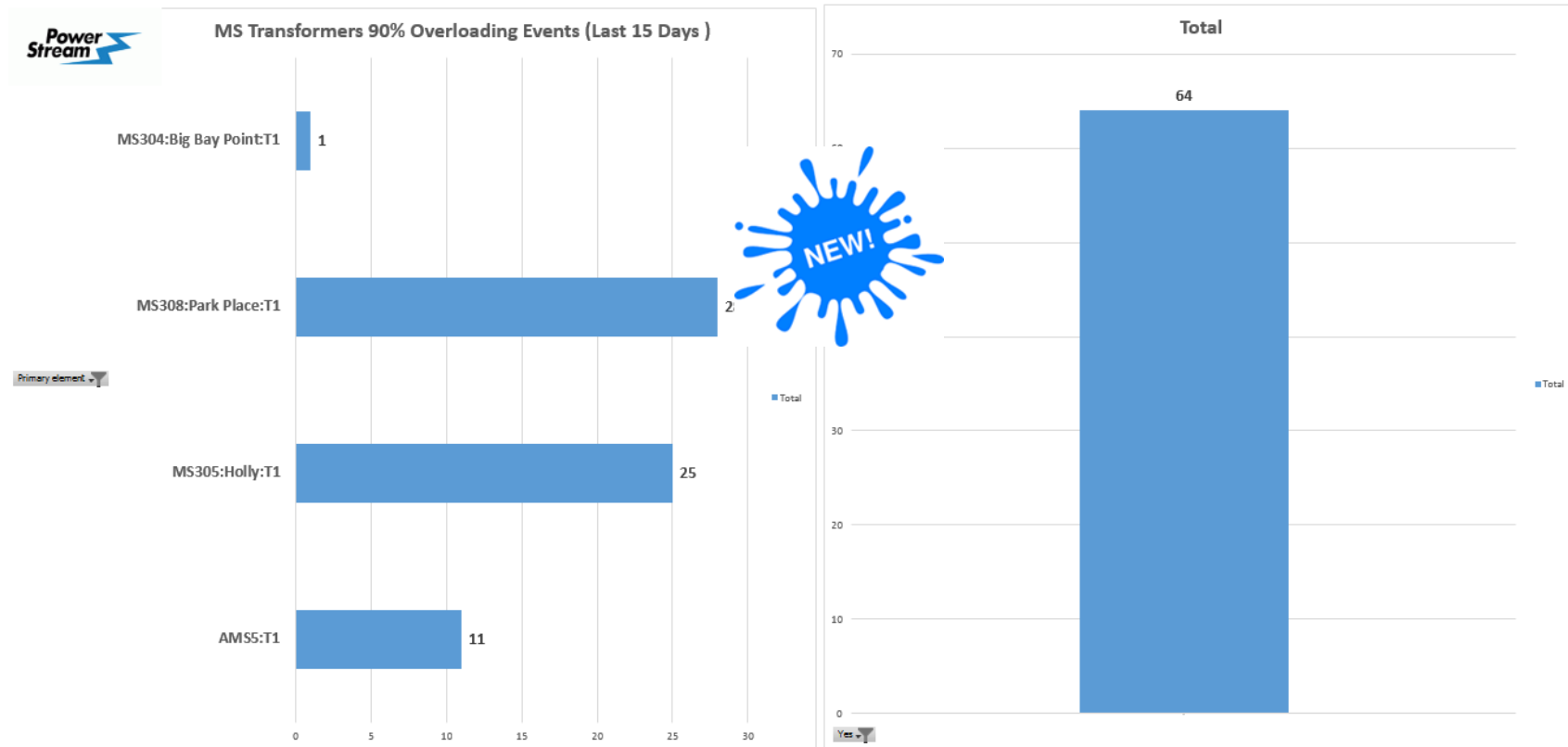
From Access From Web From Text Get External Data Show Queries From Table Recent Sources Refresh All Connections Properties Edit Links Sort Filter Advanced Text to Columns Remove Duplicates Data Validation Consolidate Relationships Manage Data Model What-If Analysis Forecast Group Ungroup Subtotal Outline

B1 : fx 01/01/2016

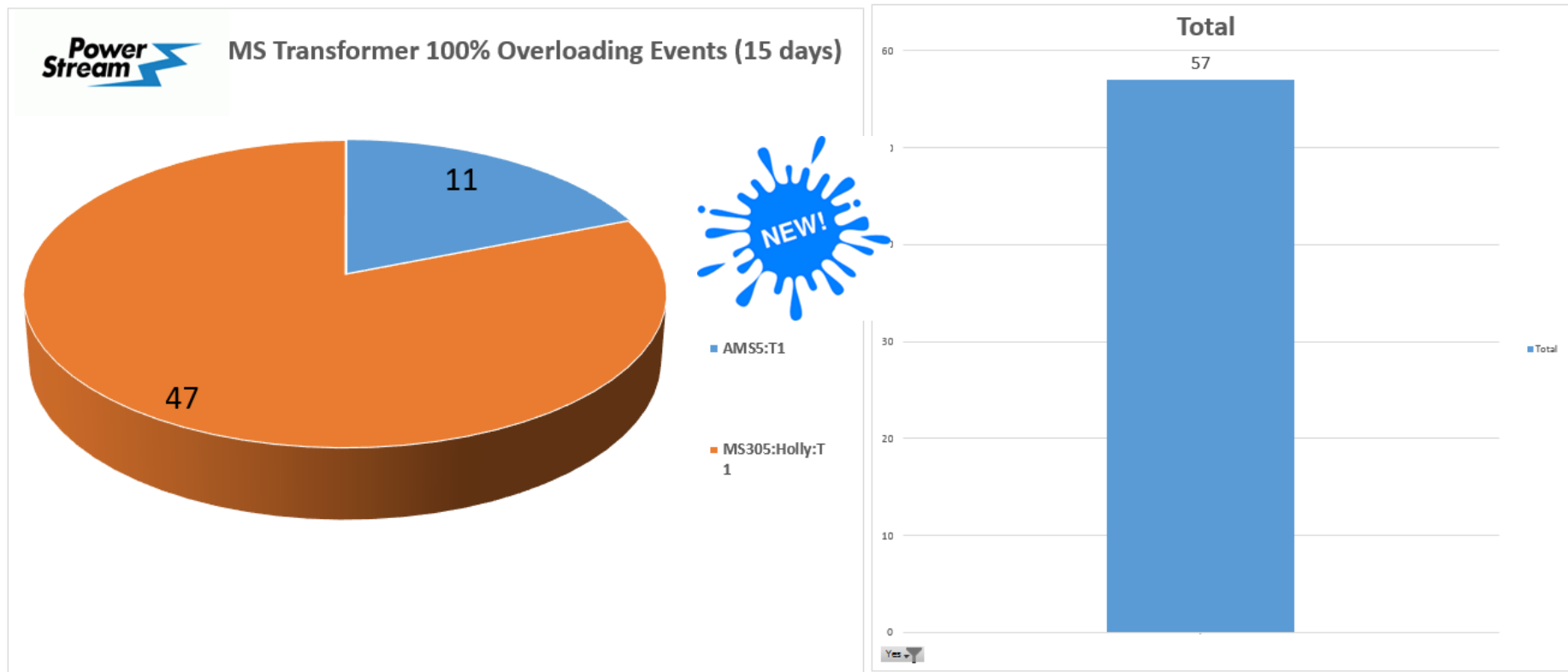
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Start Date	1-Jan-2016														
2	End Date	20/09/2016 9:40														
3	Element Name	*														
4																
5																
6																
7	Start time	End time	Duration	Primary element		70										
8	13-Mar-16 08:42:30	23-Mar-16 18:30:41	10 9:48:11	VTS1:Greenwood:T1												
9	13-Mar-16 08:43:15	23-Mar-16 18:43:46	10 10:00:31	VTS1E:Greenwood Expansion:T3												
10	13-Mar-16 09:41:08	23-Mar-16 19:20:22	10 9:39:14	VTS2:Torstar:T1												
11	13-Mar-16 10:39:33	23-Mar-16 17:35:30	10 6:55:57	RHTS2:Lazenby 2:T3												
12	24-Mar-16 04:05:34	24-Mar-16 04:06:04	0 0:00:30	VTS3:Lorna Jackson:T2												
13	24-Mar-16 06:49:51	24-Mar-16 06:50:19	0 0:00:28	VTS3:Lorna Jackson:T2												
14	28-Mar-16 07:28:09	15-Apr-16 20:40:07	18 13:11:58	VTS3:Lorna Jackson:T2												
15	25-Apr-16 11:29:37	29-Apr-16 11:16:50	3 23:47:13	VTS3:Lorna Jackson:T2												
16	04-May-16 12:46:05	06-May-16 11:13:27	1 22:27:23	MTS3E:D.H. Cockburn Expansion:T4												
17	04-May-16 13:14:39	06-May-16 11:38:16	1 22:23:38	MTS2:A.M. Walker:T2												
18	16-May-16 07:33:45	20-May-16 14:14:21	4 6:40:37	MTS4:R.M. Fabro:T2												
19	16-May-16 07:58:52	27-May-16 14:08:52	11 6:10:00	MTS3E:D.H. Cockburn Expansion:T4												
20	16-May-16 08:19:12	27-May-16 13:28:12	11 5:09:00	MTS2:A.M. Walker:T2												
21	28-May-16 08:29:20	28-May-16 08:51:50	0 0:22:30	RHTS2:Lazenby 2:T3												
22	28-May-16 08:51:52	28-May-16 10:36:24	0 1:44:32	RHTS2:Lazenby 2:T3												
23	28-May-16 15:39:50	28-May-16 15:40:54	0 0:01:03	RHTS2:Lazenby 2:T3												
24	28-May-16 15:59:56	28-May-16 16:11:07	0 0:11:11	RHTS2:Lazenby 2:T3												
25	28-May-16 16:11:51	28-May-16 16:30:26	0 0:18:35	RHTS2:Lazenby 2:T3												
26	06-Jun-16 16:53:16	16-Jun-16 10:53:14	9 17:59:58	RHTS1:Lazenby 1:T1												
27	17-Jun-16 09:17:00	17-Jun-16 10:57:42	0 1:40:42	RHTS2:Lazenby 2:T4												
28	17-Jun-16 10:57:47	17-Jun-16 10:58:53	0 0:01:06	RHTS2:Lazenby 2:T4												
29	17-Jun-16 11:15:52	17-Jun-16 11:16:03	0 0:00:10	RHTS2:Lazenby 2:T4												
30	17-Jun-16 15:16:08	17-Jun-16 16:56:12	0 1:40:04	RHTS2:Lazenby 2:T4												
31	11-Jul-16 14:28:25	11-Jul-16 14:38:32	0 0:10:07	MTS1:J.V. Fry:T2												

Ready Count Duration By Regions OriginalData SourceData +

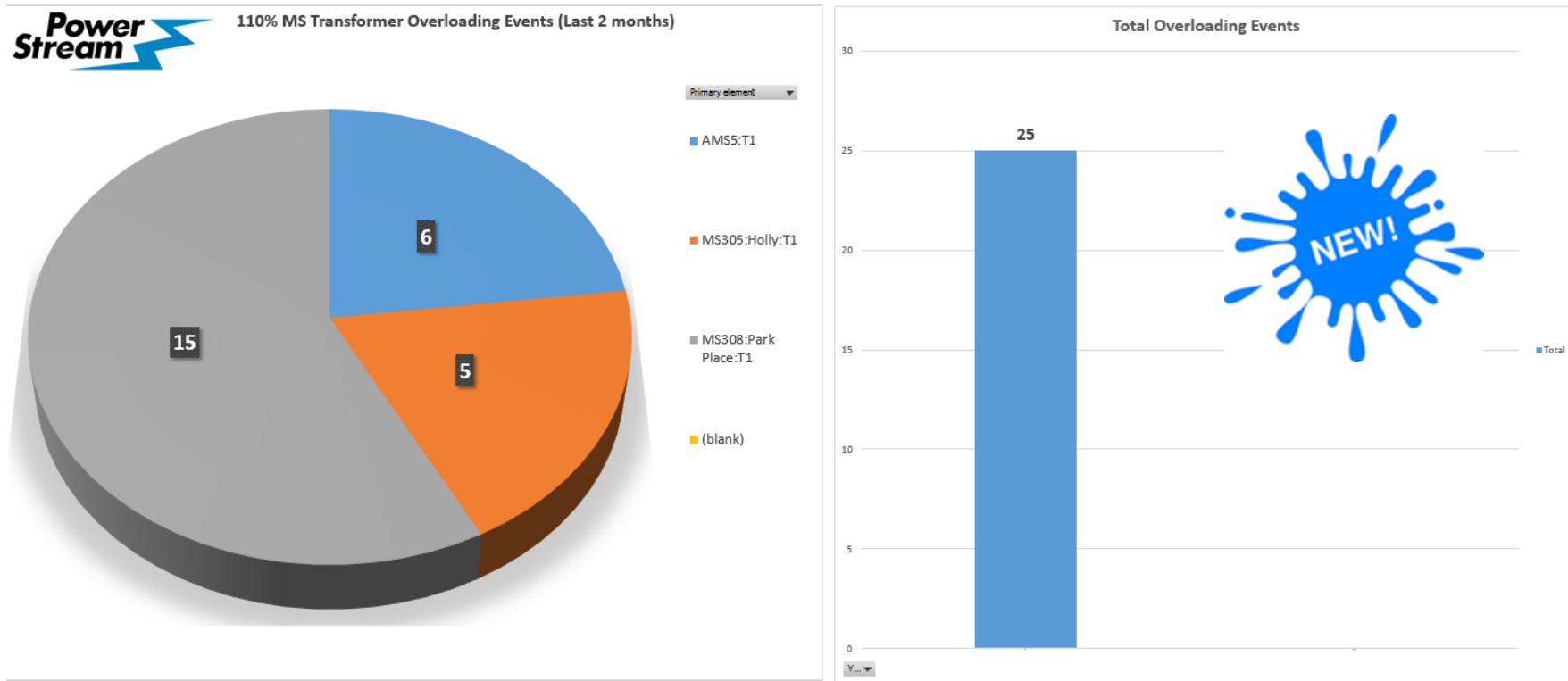
Transformer 90% Loading Events



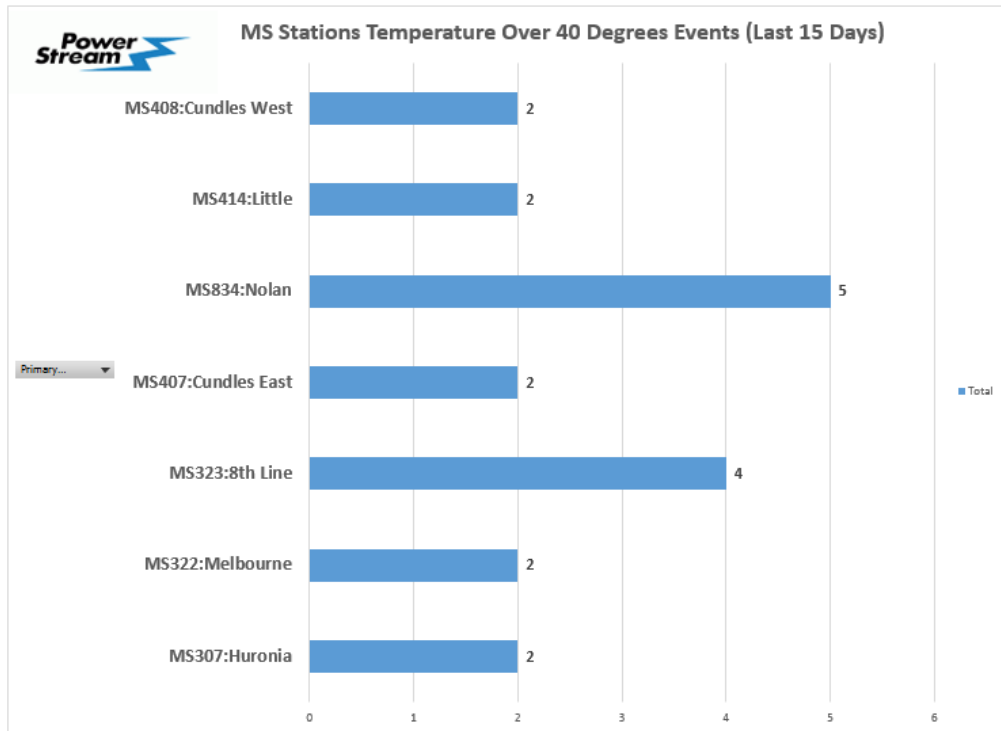
Transformer 100% Overloading Events



Substation Transformer 110% Overloading Events

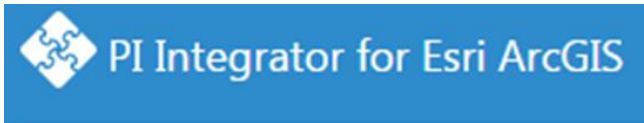


Substation Building Temperatures Over 40°C Events



PI Integrator for ESRI ArcGIS

- New installation – August 2016
 - Successful Pilot Project
 - Used to demonstrate capabilities of leveraging PI System and GIS system (ESRI)
- Overall very satisfied, lots of potential
 - Initially a few challenges for a non ESRI user
 - PI Integrator for ESRI ArcGIS easy tool to learn
 - Fast learning curve with excellent support by both OSIsoft and ESRI

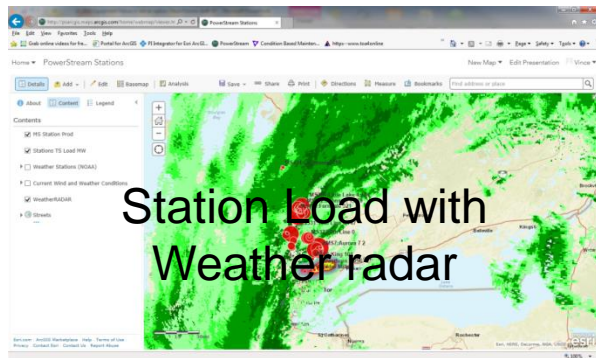
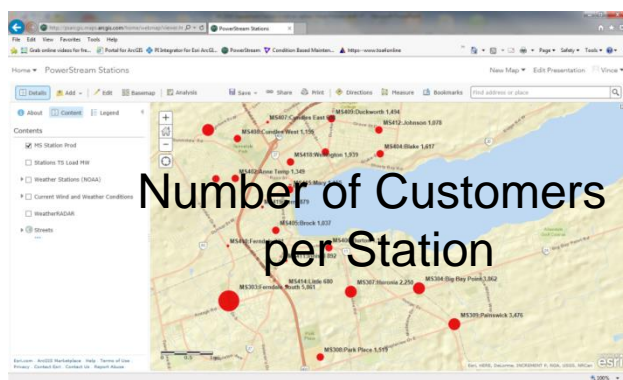
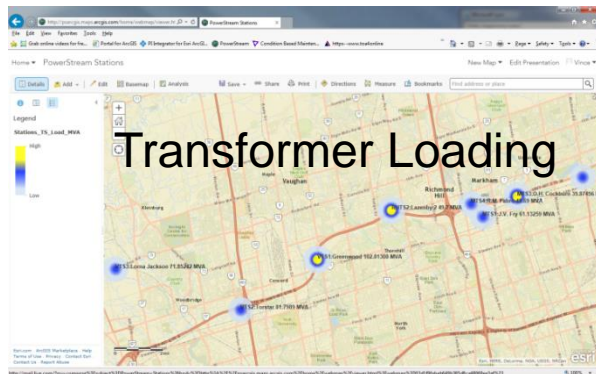


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Sample PI-ESRI Reports



- 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

Name	Report	Created	Last Modified	Stream Display	Count	Actions
Stations-Test	PowerStream municipal and transformer stations	02/24/2016	03/02/2016	Stream Display	2	[Edit] [Delete]
Stations_ProdRP1	Stations_ProdRP1	05/17/2016	04/21/16	Stream Display	6	[Edit] [Delete]



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Benefits of PI System



- True Condition Based Maintenance enabler
- Maintenance Optimizer
- Stores Key Information for Asset Management Decision Making
- Innovation stimulant
- Instant Information to those who need it
- Fast learning curve
 - OSIsoft YouTube, Manuals, Support, Training

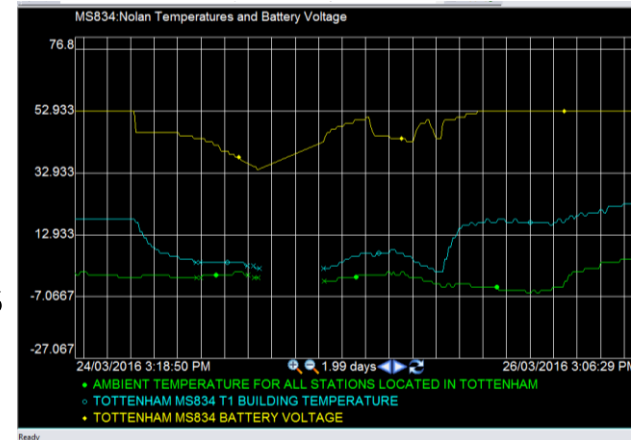
Ice Storm March 24, 2016 – PI System Benefits

- Up to 50,000 customers affected

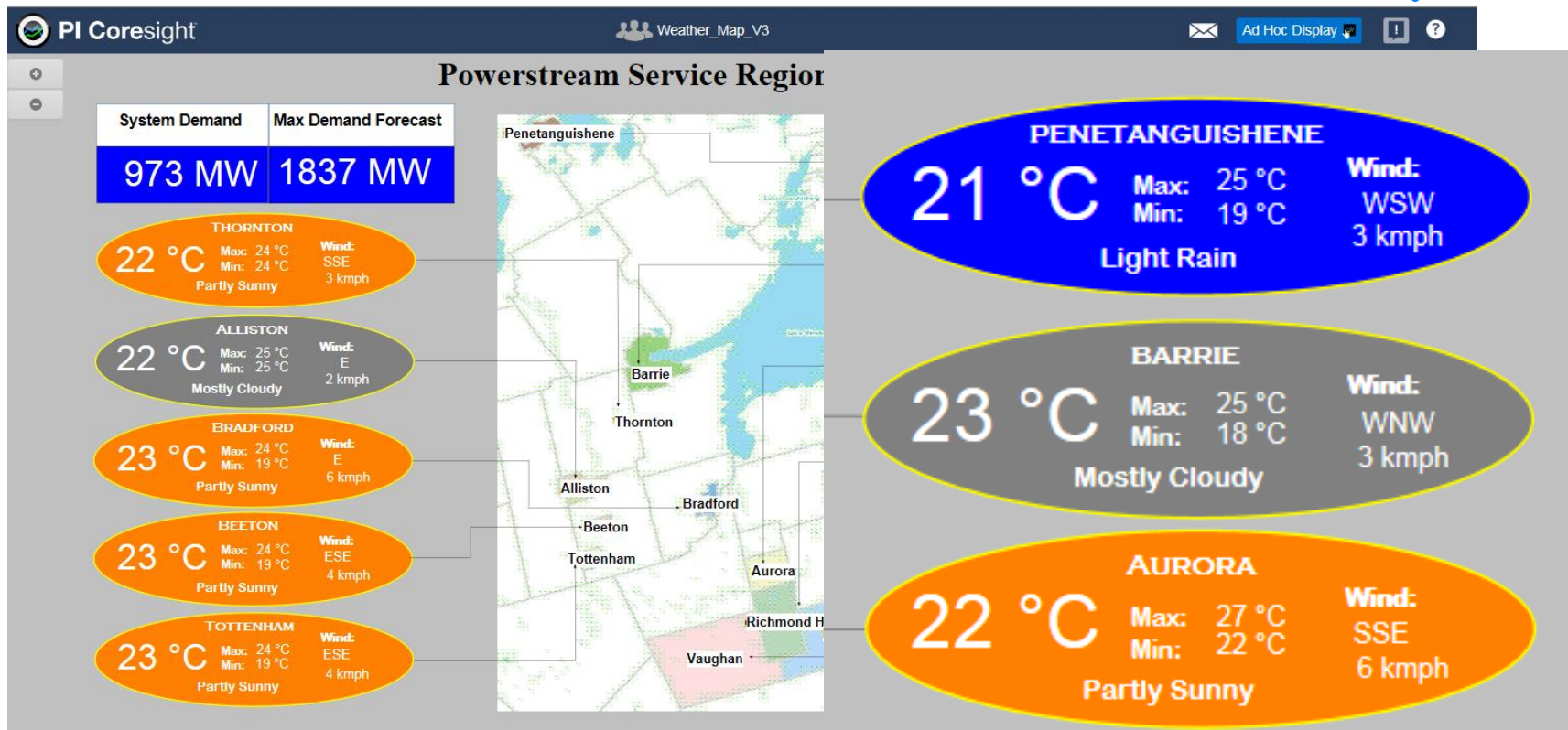


Used PI System and **PI Notifications** to monitor system and station equipment

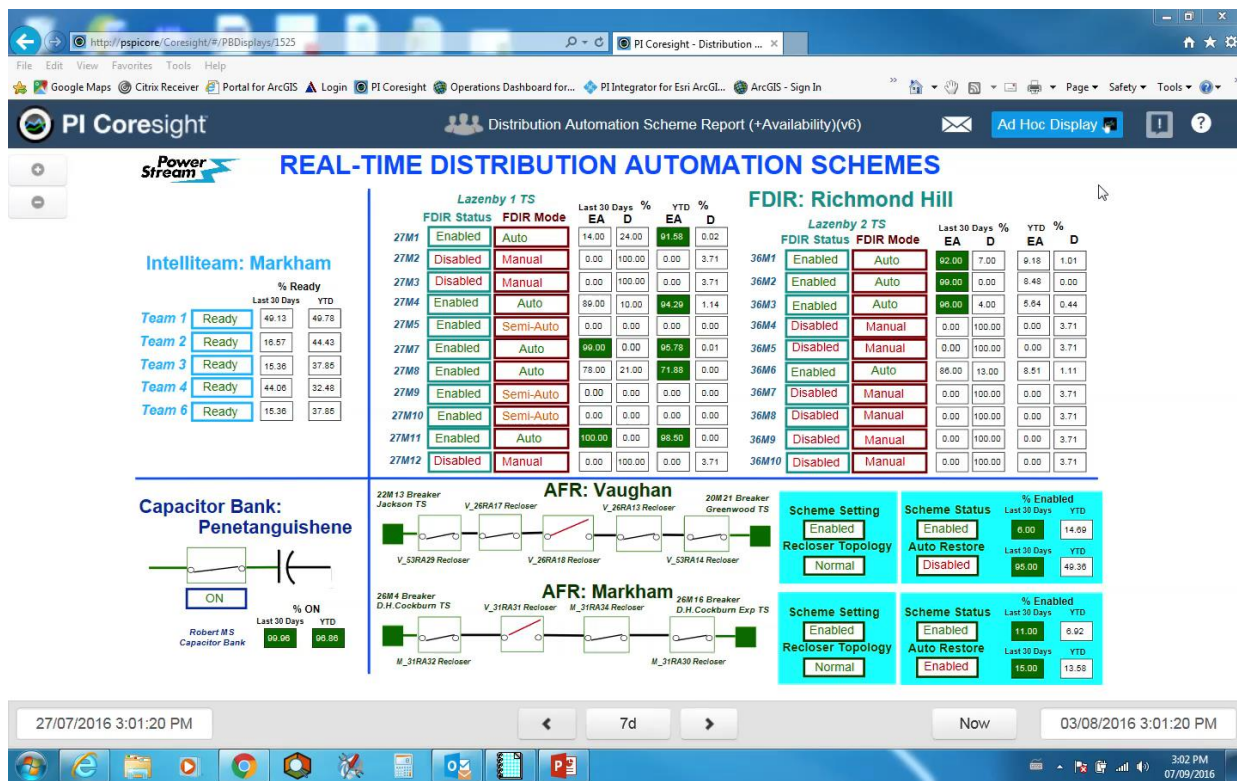
- Number of outages and Customers affected by Region
- Breaker Operations
- Transformer de-energization/energization
- Protection “trips”
- Battery charger status and battery voltages



PowerStream Service Territory Weather Report



Real-Time Distribution Automation Schemes Performance Report



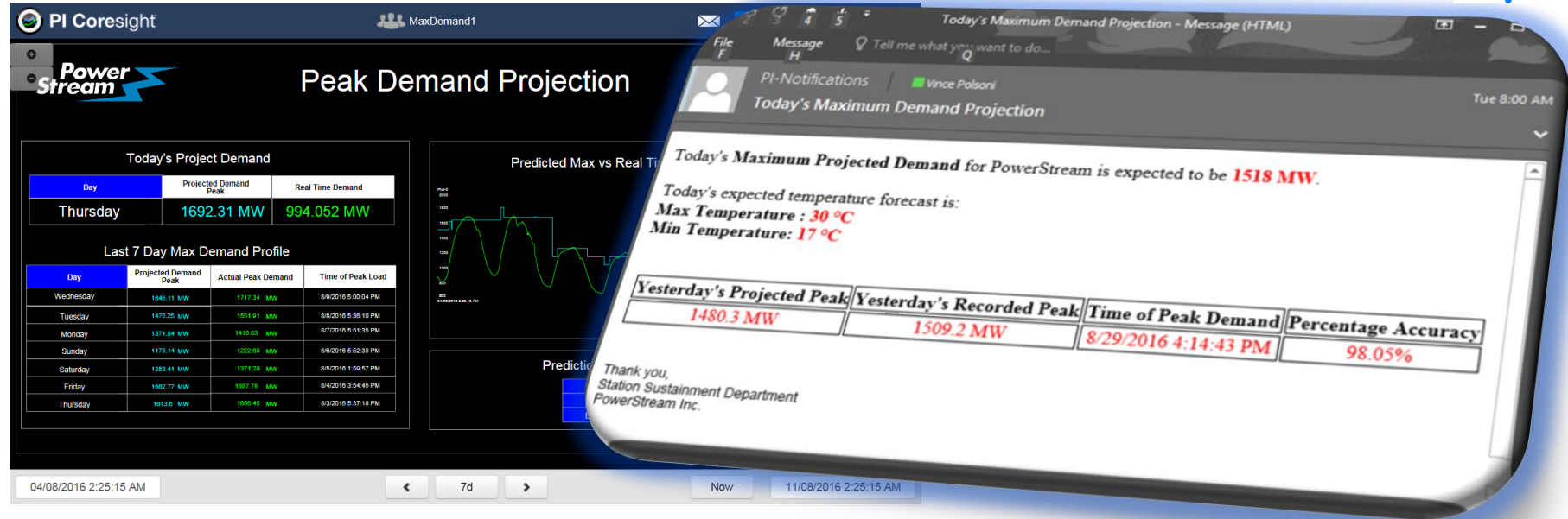
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Daily Peak Projection Report



- Uses Historical load and Weather data
- Built in adjustment for summer and winter temperatures
- Calculated in PI AF Analysis
- Daily Notification at 8:00am



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OSIsoft PI System: Achieving Operational Efficiency

COMPANY and GOAL

PowerStream 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

Operational data is not readily available for all business units who need it.

- Data not available on corporate network
- Data is not easily accessible
- Archive data difficult to access and query

SOLUTION

Used the PI System as a means of enabling corporate system to allow access to operational data.

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

RESULTS

System and equipment condition awareness increased across complete organization.

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



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Contact Information

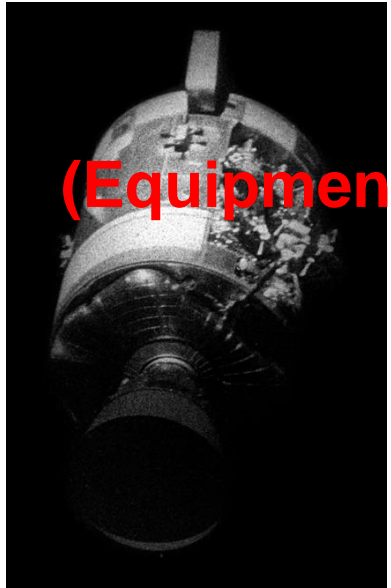
Vince Polsoni

vince.polsoni@powerstream.ca

Manager Station Sustainment

PowerStream Inc.





(Equipment)

Let's build
some Pi
Reports!

I am calling
my brother
Ron for help

Failure is Not an Option!
(When you have a PI System)

Questions

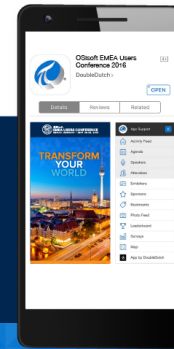
Please wait for the **microphone** before asking your questions



State your **name & company**

Please remember to...

Complete the Online Survey for this session



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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado



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