

The background of the image is a dark blue gradient with a faint, stylized cityscape of San Francisco, including the Golden Gate Bridge and the Transamerica Pyramid. The OSIsoft logo is positioned at the top center.

**OSI**soft®

# USERS CONFERENCE 2016

April 4-8, 2016 | San Francisco

**TRANSFORM**  
**YOURWORLD**



# **“Equipment Failure” is Not an Option**

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



# “Equipment” Failure is Not an Option





An Event Frames Report would have come in handy now

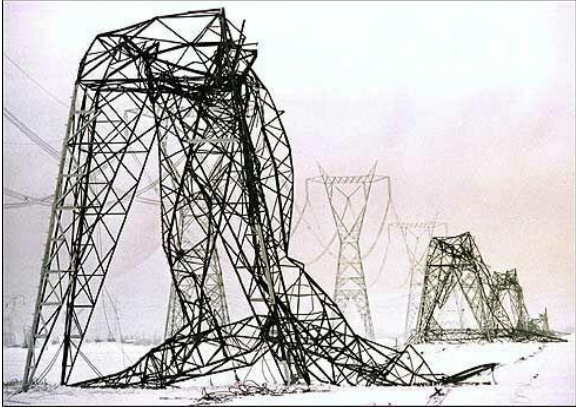
Is this calculation correct? Where did he get the data?

ish I had System Dashboard





# Equipment Failures One Wishes to Never Experience (again)



# Agenda – Equipment Failure is Not an Option

- Operations - Asset & Maintenance Management
  - PI System at PowerStream
  - CMMS integration with PI System
  - PI Data and Reporting
- Technology and Innovation
  - PI Dashboards, ESRI-PI maps



# Where are we?

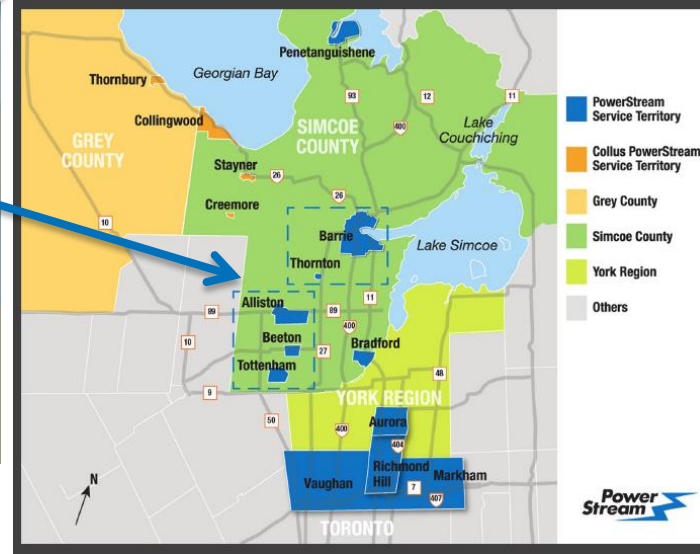


Ontario  
1,068,587 km<sup>2</sup>



Texas  
696,200 km<sup>2</sup>

## Powerstream Service Territory



## Powerstream Service Territory

- 806 km<sup>2</sup>
- 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



# Background to Present 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 WebParts)
  - Operational reports (PI ProcessBook, PI Coresight, PI DataLink, PI Web Parts)

## 2016

- PI Integrator for Esri ArcGIS, Event Frames, Future Data
- Merger (add new assets)
- Rework PI System

# The Plan


# 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



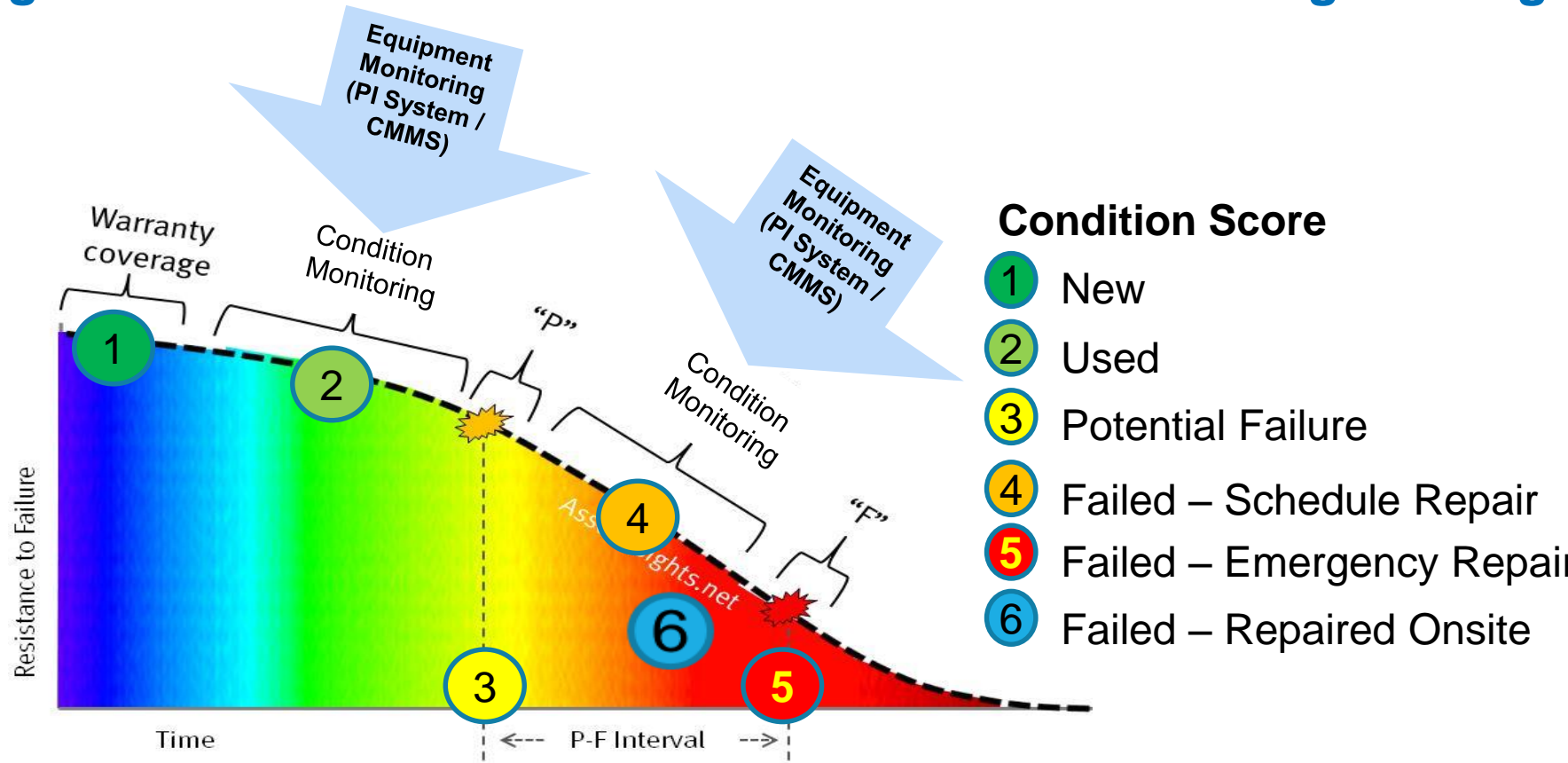


# Leveraging PI System at Powerstream

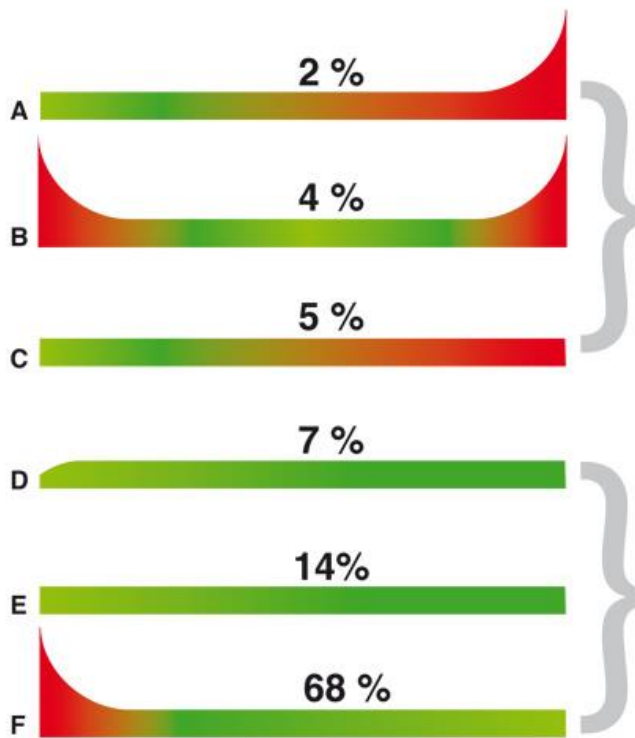
- Operations Dashboards (Public Monitors, Tablets)
- PI Integrator for Esri ArcGIS 
- Interface to multiple databases/systems
  - SCADA, OMS/CIS, CMMS, MicroGrid
  - Integrators: PI HTML, PI UFL, PI RDBMS
- Expand Notifications / Alerting to stakeholders (email)
- PI Asset Framework, Performance Equations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



# Using Potential Failure “PF” Curve – Condition Monitoring Scoring



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



11 % Probability of failure connected to operating age



89 % Probability of failure **not** connected to operating age

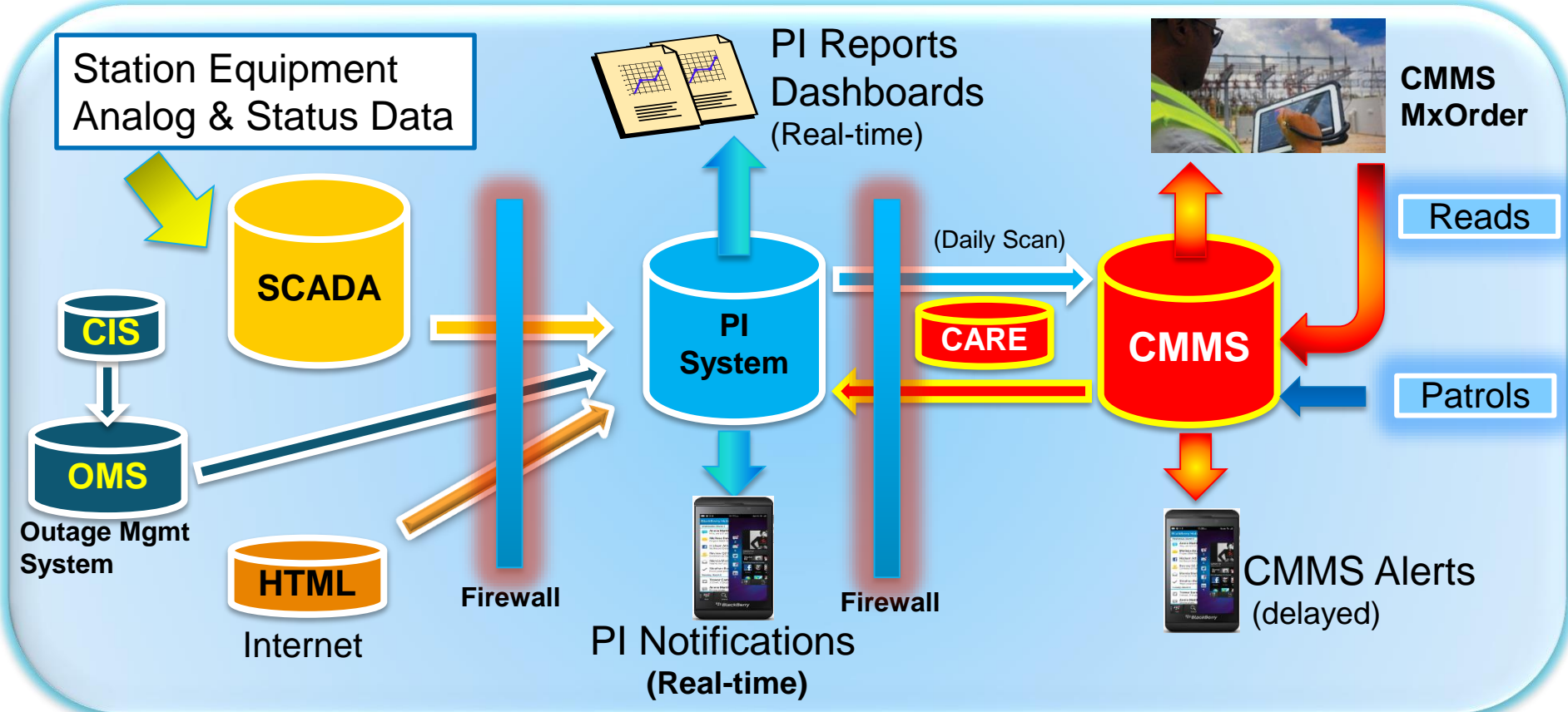


**if it ain't broke don't fix it**

- Premature random failures
- Human Intervention

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

# Condition Based Maintenance - Data Flow






# PI Data used in CMMS to Trigger Maintenance Tasks

- Transformer Loading
- Transformer Oil Temperature
- Transformer Tap Positions (monthly max and min and if passed through neutral)
- Transformer Tap Changer Oil temperature vs main Tank Oil Temperature
- Transformer Bushing Monitoring Power Factor & Capacitance
- Breaker Operations in last 24 hours and last 6 months
- Breaker Max Amps
- Breaker Fault Current
- SF6 Gas Alarm
- Low Battery Alarm
- Tap Changer Operations
- High Water Alarms





# 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



# Integrated Products



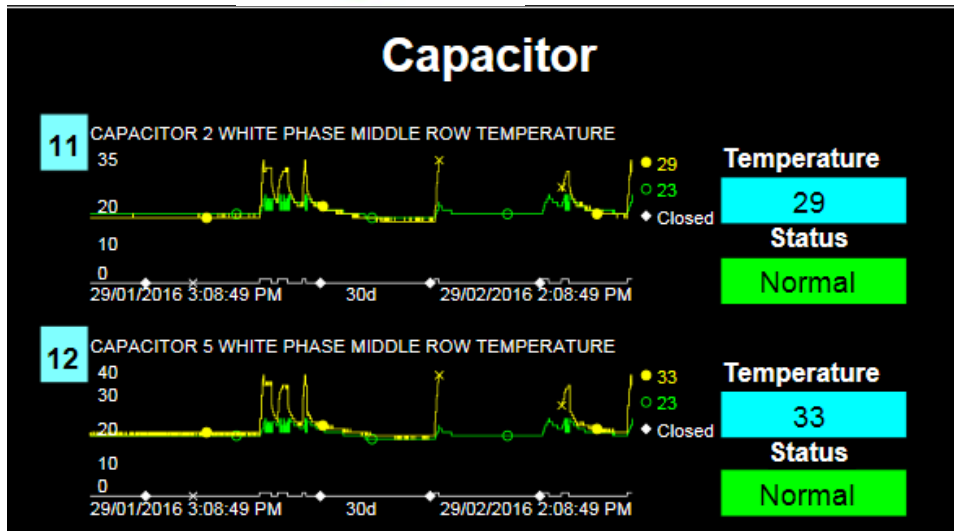
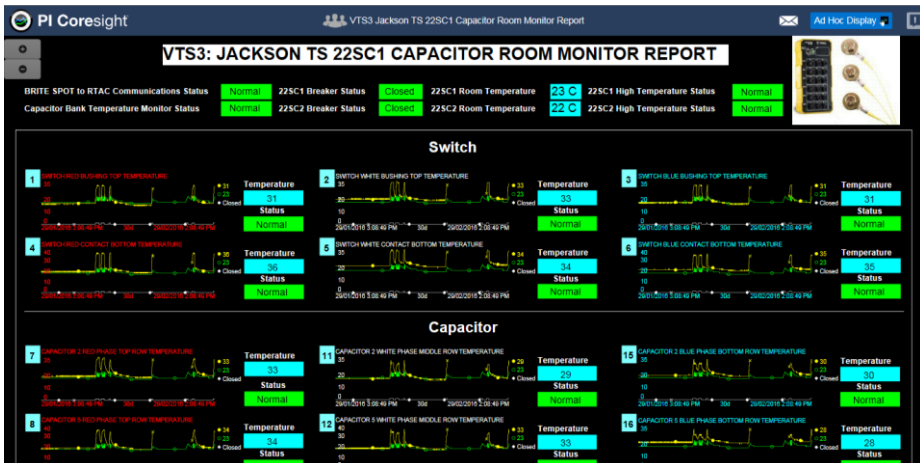
# Equipment Monitoring

- SEL 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 (new 2015)



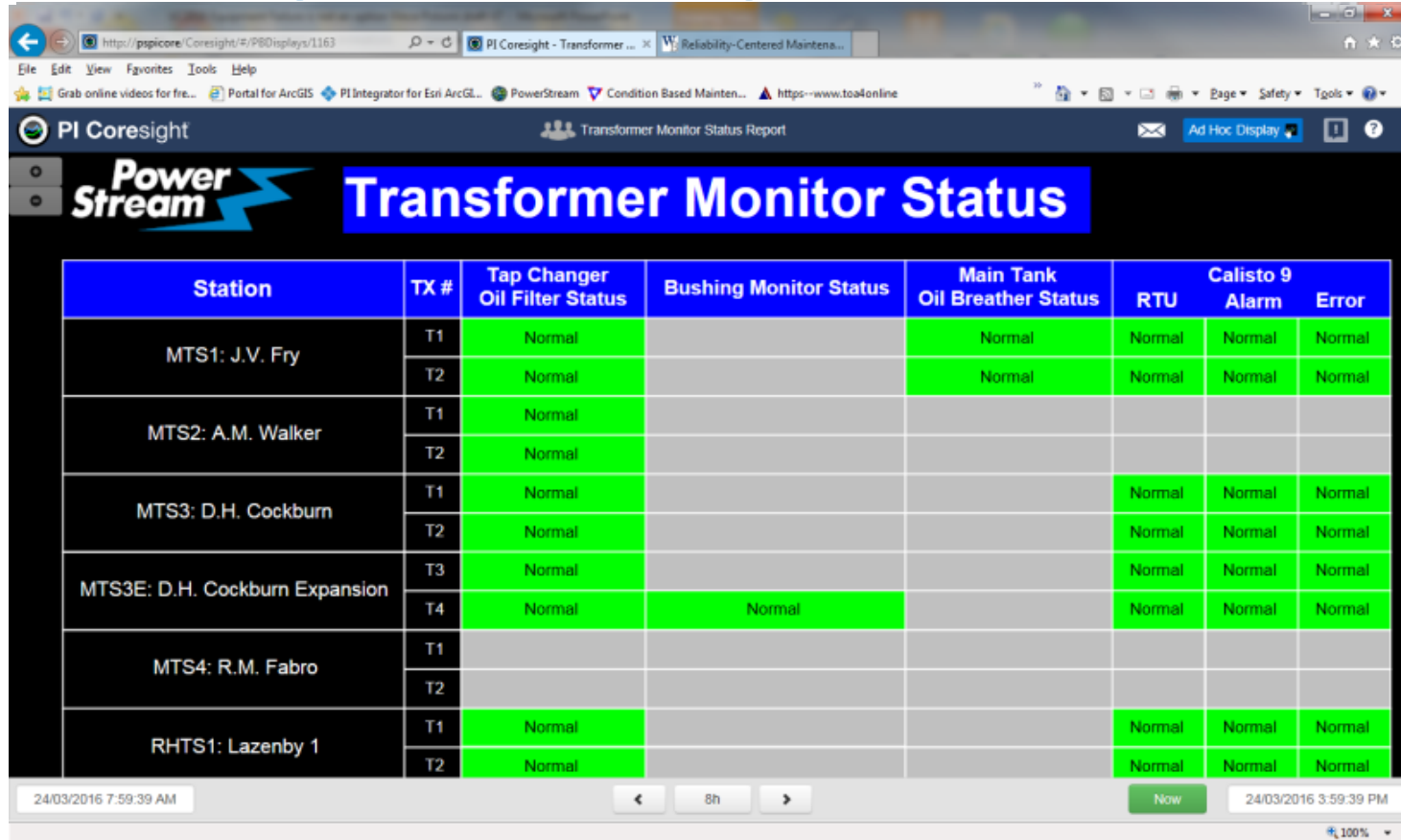


# Capacitor Bank Room Temperature



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

# Monitoring our Monitoring units



PI Coresight Transformer Monitor Status Report

**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

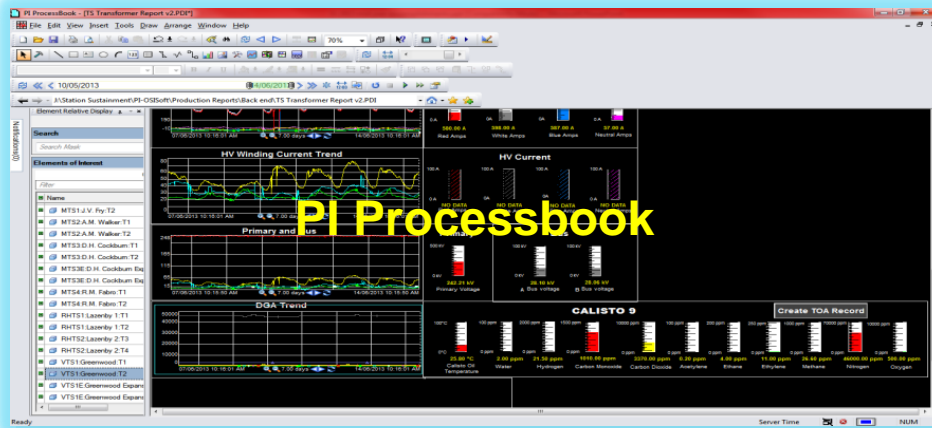
24/03/2016 7:59:39 AM 8h 24/03/2016 3:59:39 PM

# Expert Systems Working in Unison



Project

# Dissolved Gas Analysis in Transformer PI ProcessBook, TOA4 and CMMS



**PI Processbook**

Daily or on demand

The TOA4 report displays a 'Gas Analysis' table with columns for 'Gas', 'Unit', 'Value', and 'Trend'. The table lists various gases including H<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, CO, CO<sub>2</sub>, and others, along with their concentrations and trends. A 'Daily' trend is indicated for several gases.

**TOA4**

daily



**Transformer Problem Identified (Health and Risk Increase)  
PI Notification and CMMS Alert**

The CMMS interface shows a list of equipment with columns for 'Equipment', 'Status', 'Risk', 'Work Area', 'Location', 'Equipment Category', 'Equipment Type', 'Equipment Position', and 'Equipment Class'. A red circle highlights a specific entry in the list, indicating a problem identified.

**CMMS**

# Leveraging PI System for Risk Based Condition Based Maintenance

## Integration

- Automatically Generate maintenance task in CMMS system from PI Data
- Data from CMMS and OMS into PI System

## Real-time Alerting

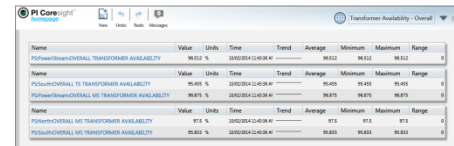
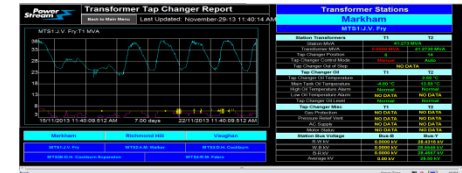
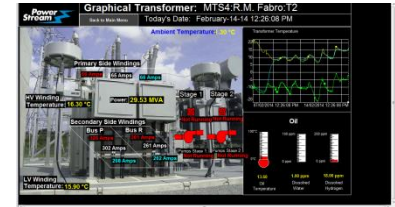
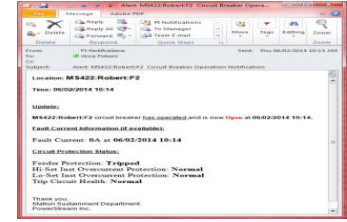
- Notifications and Alerts (Real-time)
- Provide meaningful information in content

## Asset Condition & Analytics

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

## User Friendly Simple Tools

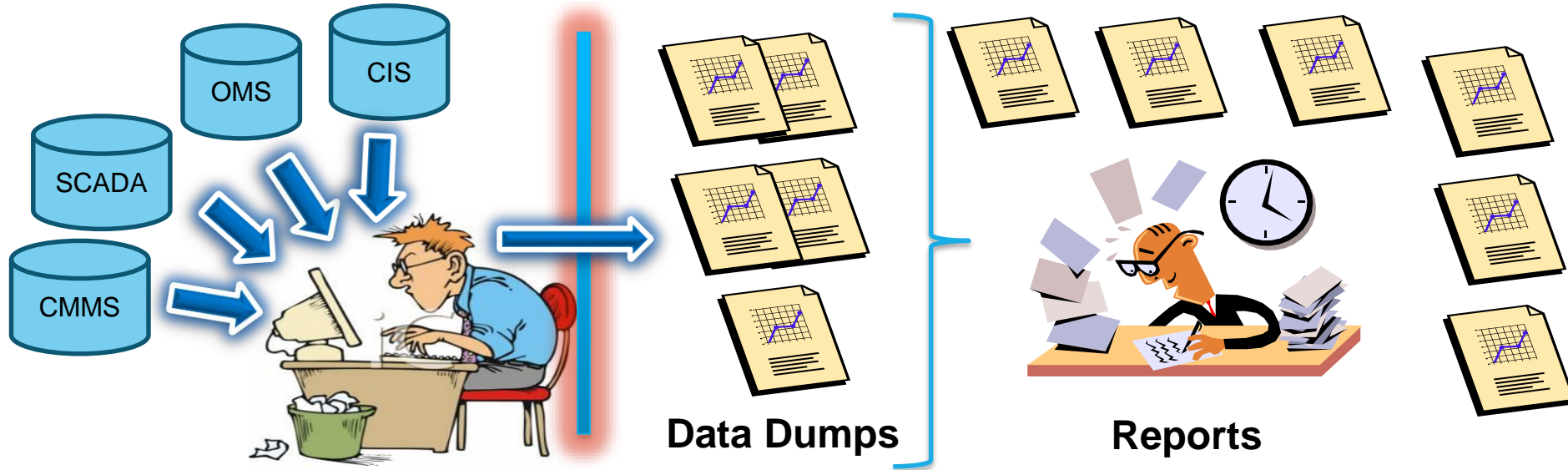
- PI Coresight / PI ProcessBook and PI DataLink
- PI Asset Framework (AF) and Templates
- Interfaces, Use various display tools





# Operations Reporting - Life before PI System

- 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 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



# How PI System Explorer is used at PowerStream

- PI Asset Framework (AF)
  - Key Station Equipment and Distribution System Assets
- 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 1400 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: 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:Greenwood )
- TRN Loading: VTS1E:Greenwood Expansion:T4 (VTS1E:Greenwood )
- 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	
<b>System Reports</b> 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"/>		<b>Transformer Reports</b> 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"/>		<b>Circuit Breaker Reports</b> 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"/>	
<b>Single Line Diagrams</b> 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"/>		<b>Switch Reports</b> Primary Switch Report <input type="button" value="Open"/>		<b>DGA Reports</b> MS DGA Report <input type="button" value="Open"/> TS DGA Report <input type="button" value="Open"/>	
		<b>DC Systems Reports</b> North DC Systems <input type="button" value="Open"/> South DC Systems <input type="button" value="Open"/>		<b>Bushing Monitor Reports</b> Combined <input type="button" value="Open"/>	
<b>230kV &amp; 44kV System Diagrams</b> 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"/>		<b>CHR Reports</b> TS Transformers <input type="button" value="Open"/>		<b>Distribution Automation Scheme Report</b> DAS Report <input type="button" value="Open"/>	
				<b>Capacitor Room Report</b> VTS3:Jackson TS Capacitor Monitor Room Report <input type="button" value="Open"/>	

# TS Transformer Report – PI ProcessBook

Links:

- Weather report
- Radar Map Link

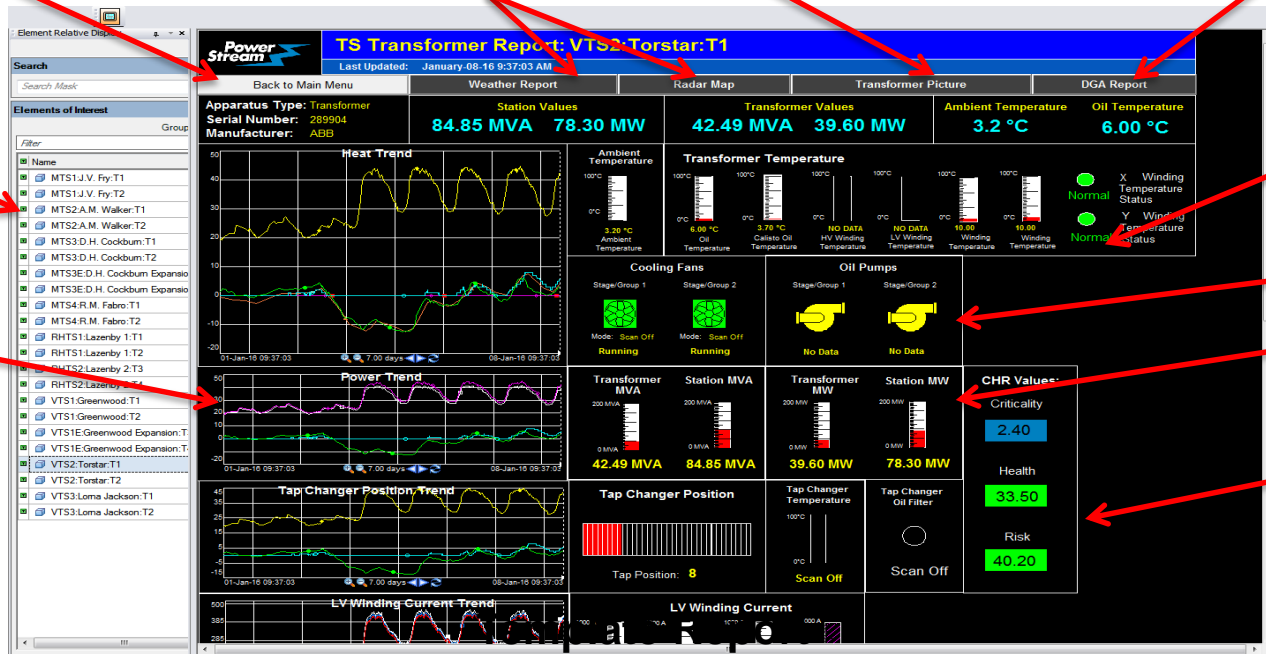
Pictures

External Database/App

Equipment Attributes

AF Elements

Trends



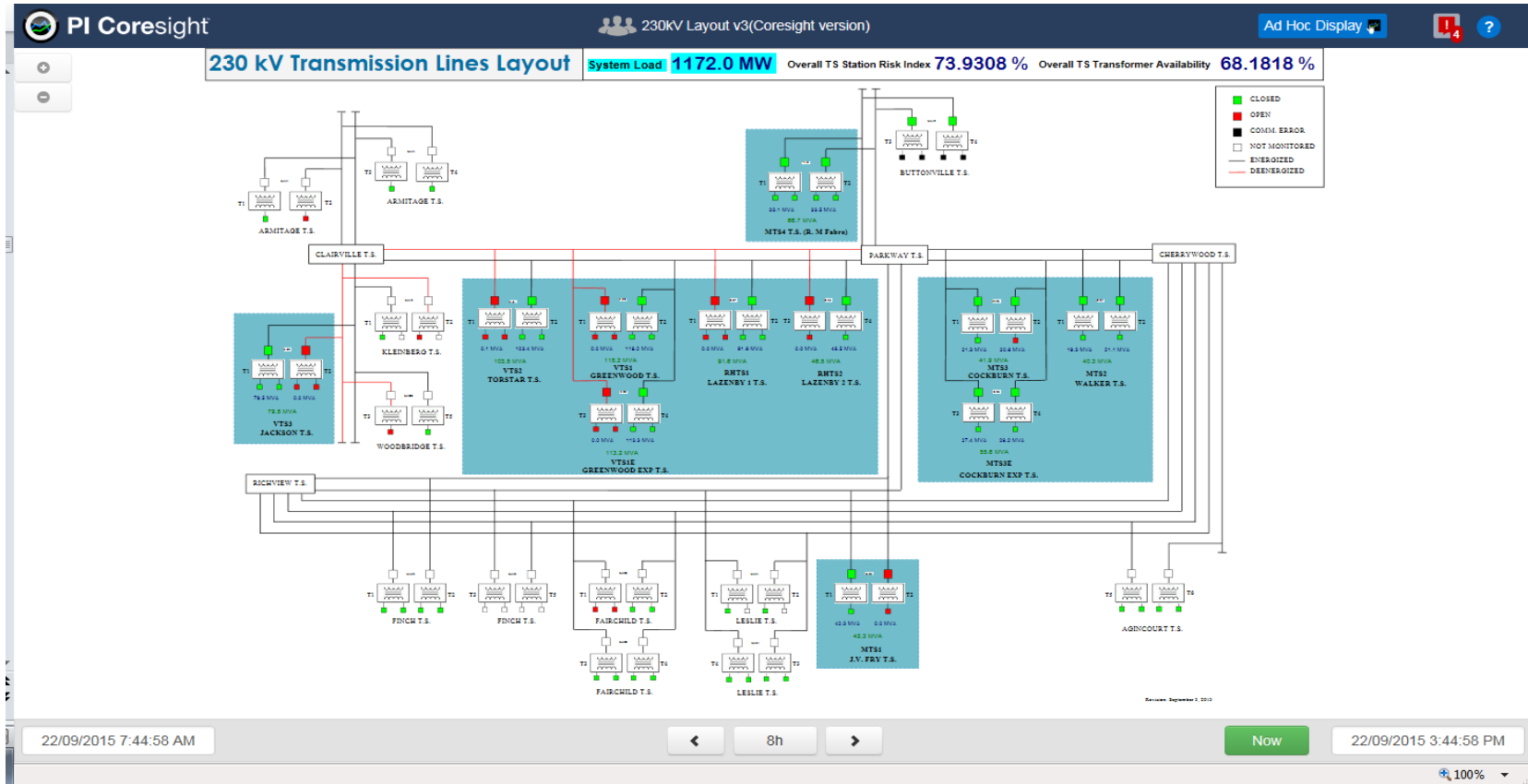
Status

Animations

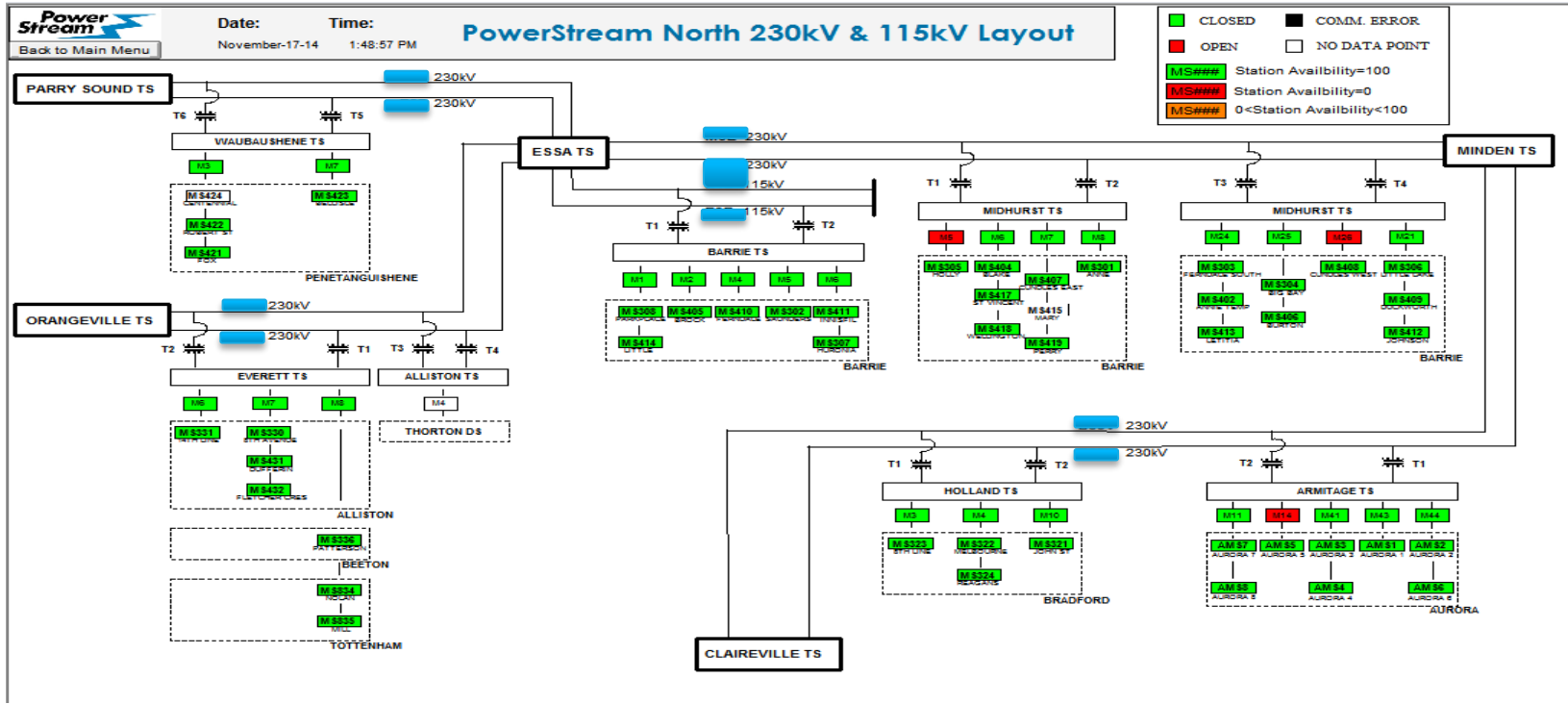
Gauges

Heath and Risk Index

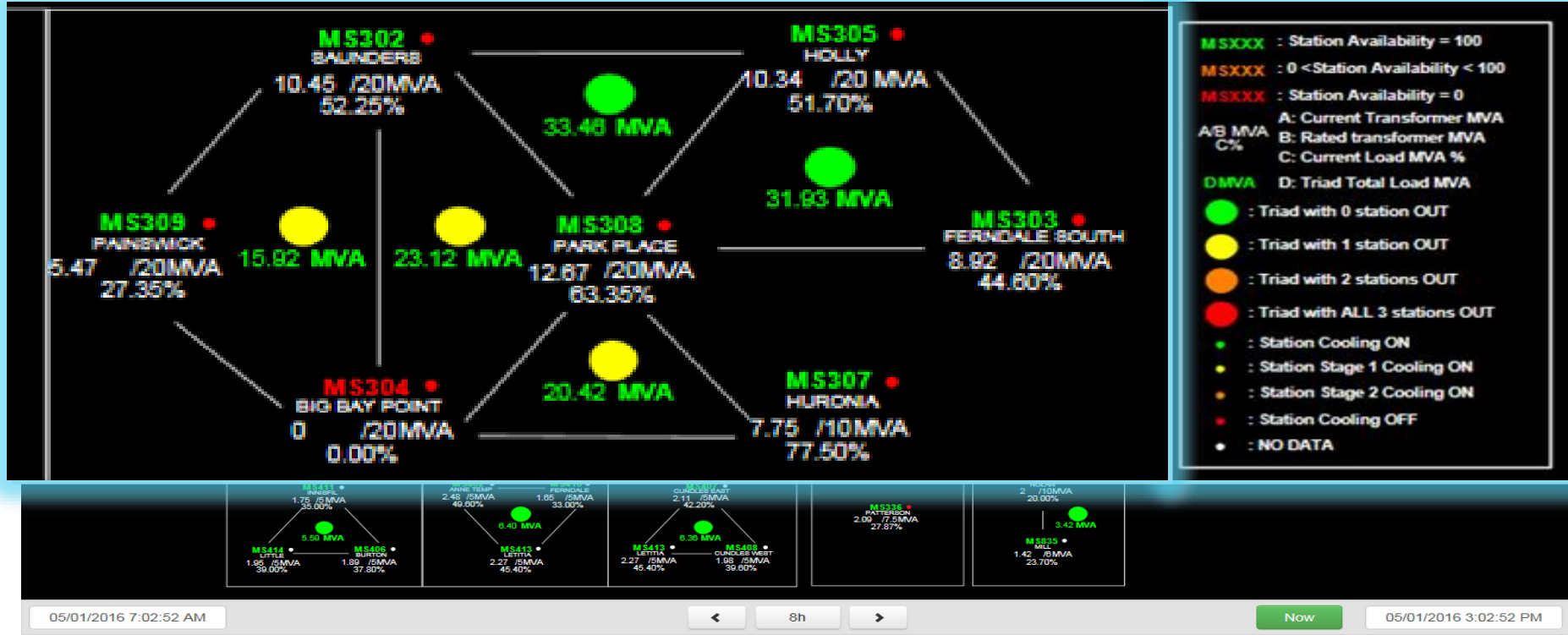
# 230kV Transmission Supply Status Report



## 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)



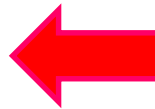
MTS3:D.H. Cockburn	
Station Status	On
Station Risk Index	100
Transformer Availability	100
Bus Availability	100
Bus E Availability	LIVE
Bus E Voltage	28.65
Bus Z Availability	LIVE
Bus Z Voltage	28.67
Feeder Breakers Closed (%)	100
RHTS2:Lazenby 2	
Station Status	On
Station Risk Index	65.625
Transformer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

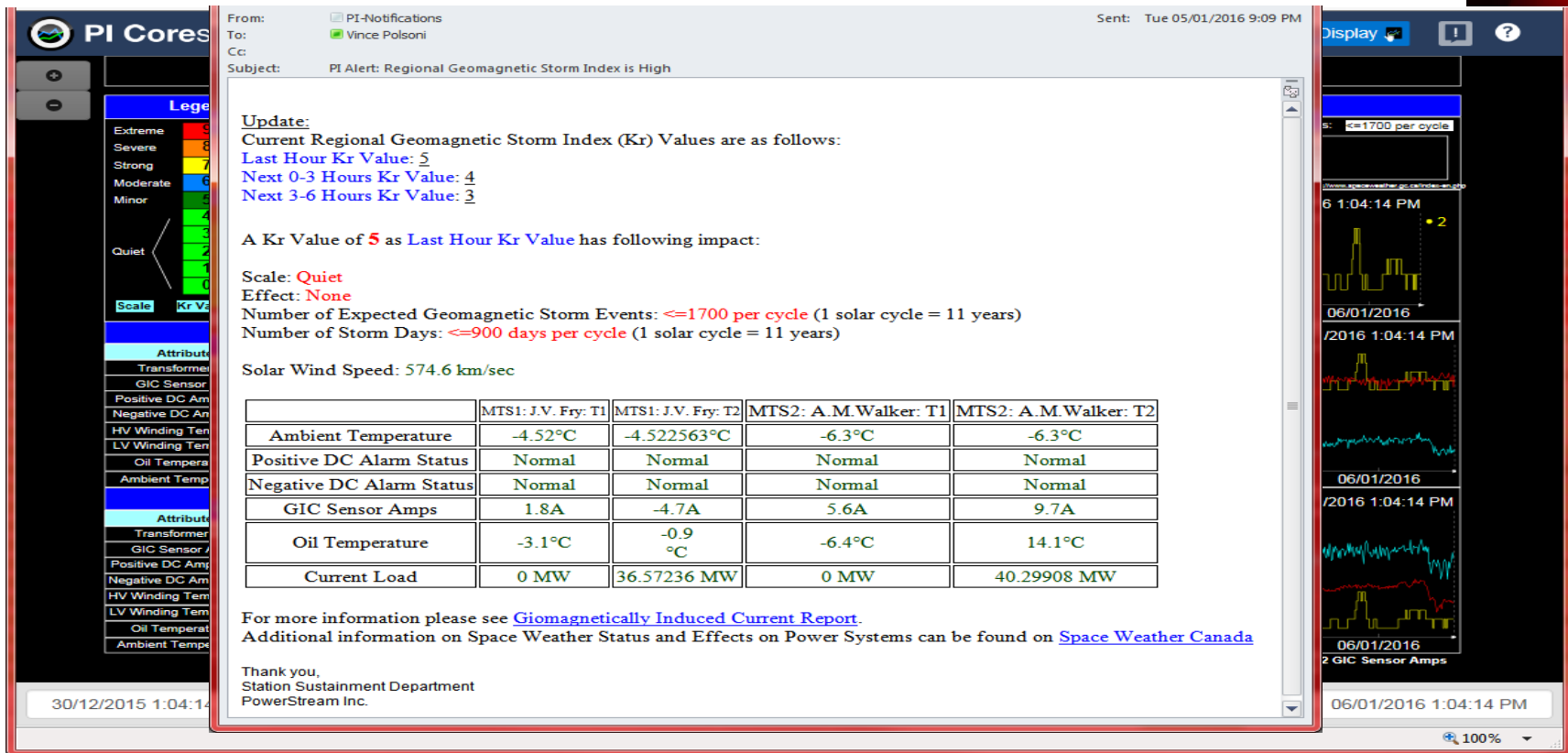


Algorithms  
(Performance Equations)

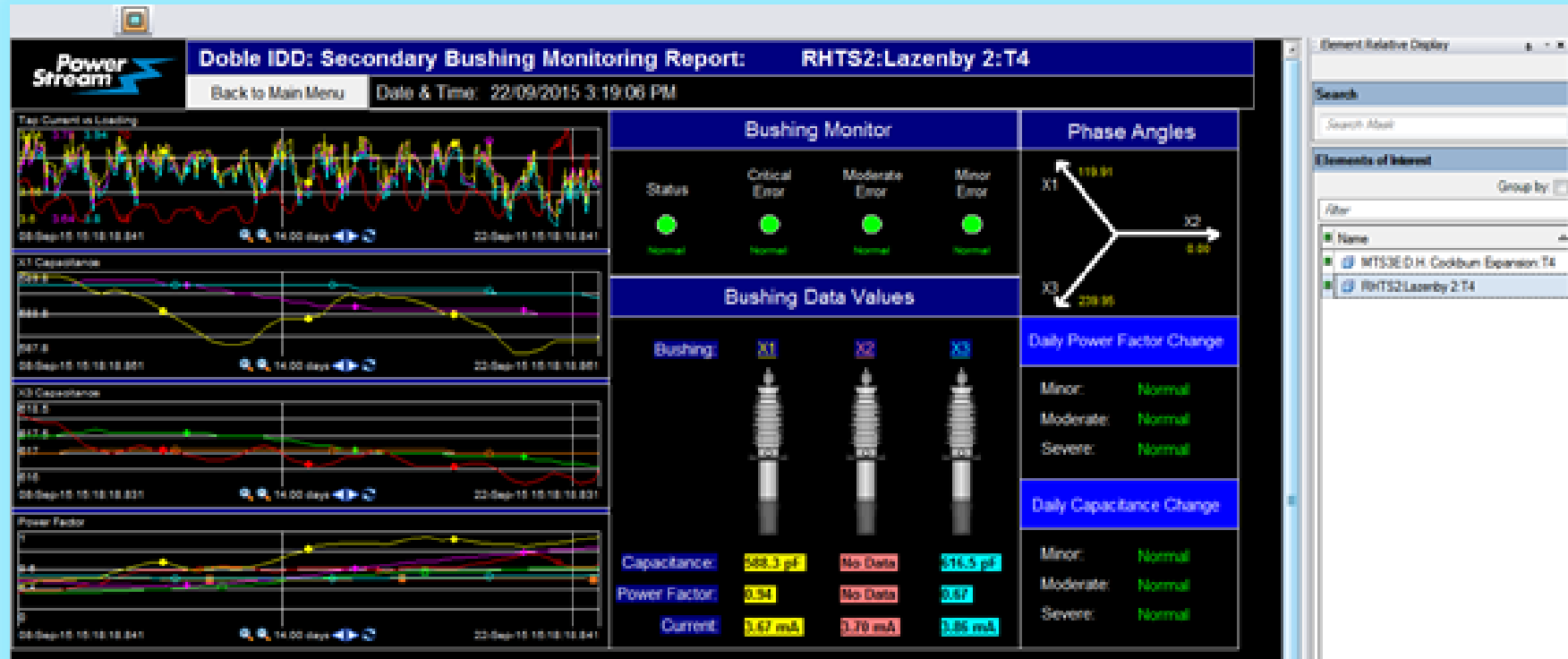




# Geomagnetically Induced Current Report

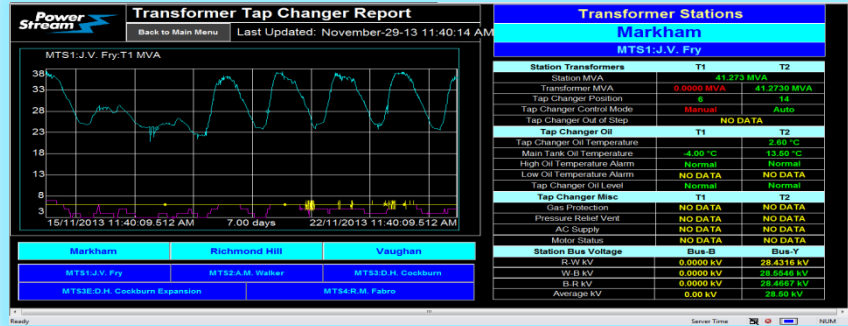


# Transformer Online Bushing Report

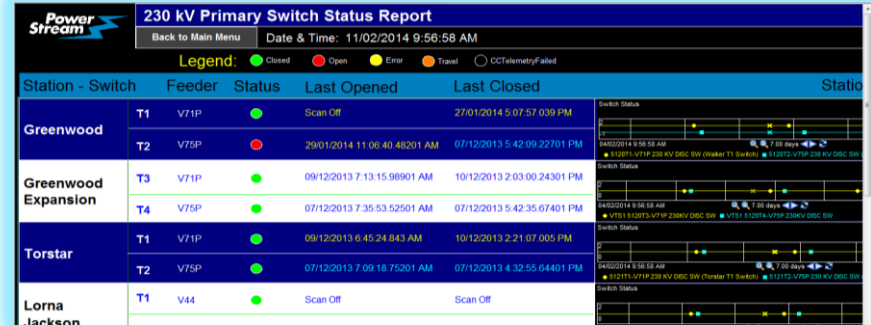


# PI ProcessBook Reports

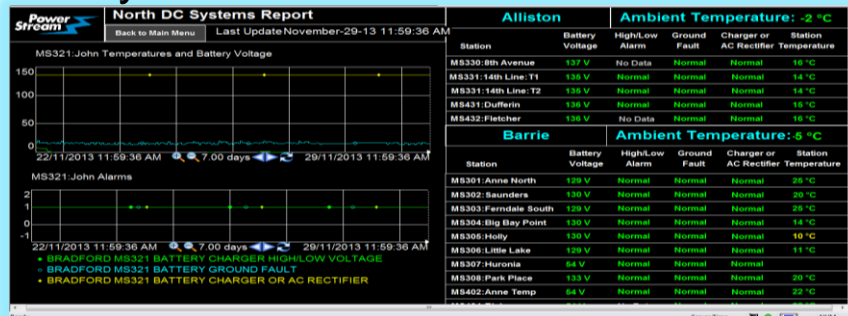
## Tap Changer



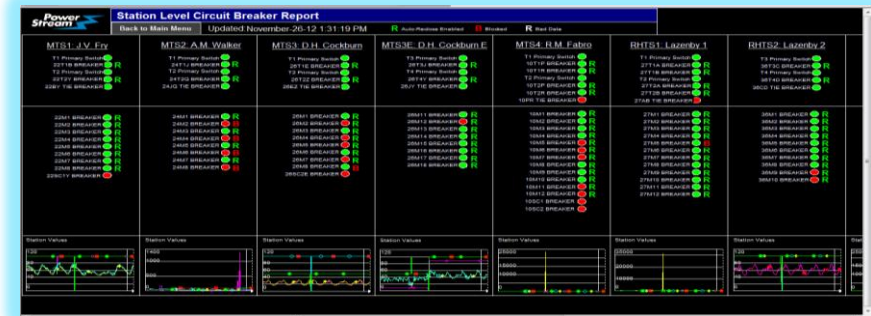
## 230 kV Primary Switch Status



## DC Systems

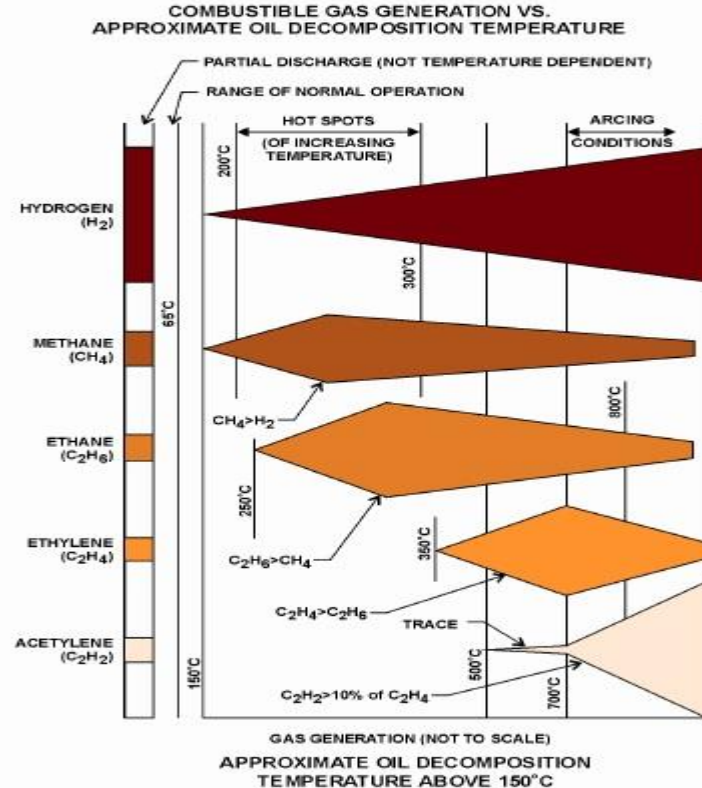


## Circuit Breaker Status



# Substation Transformer Hydrogen Gas Alarm Report

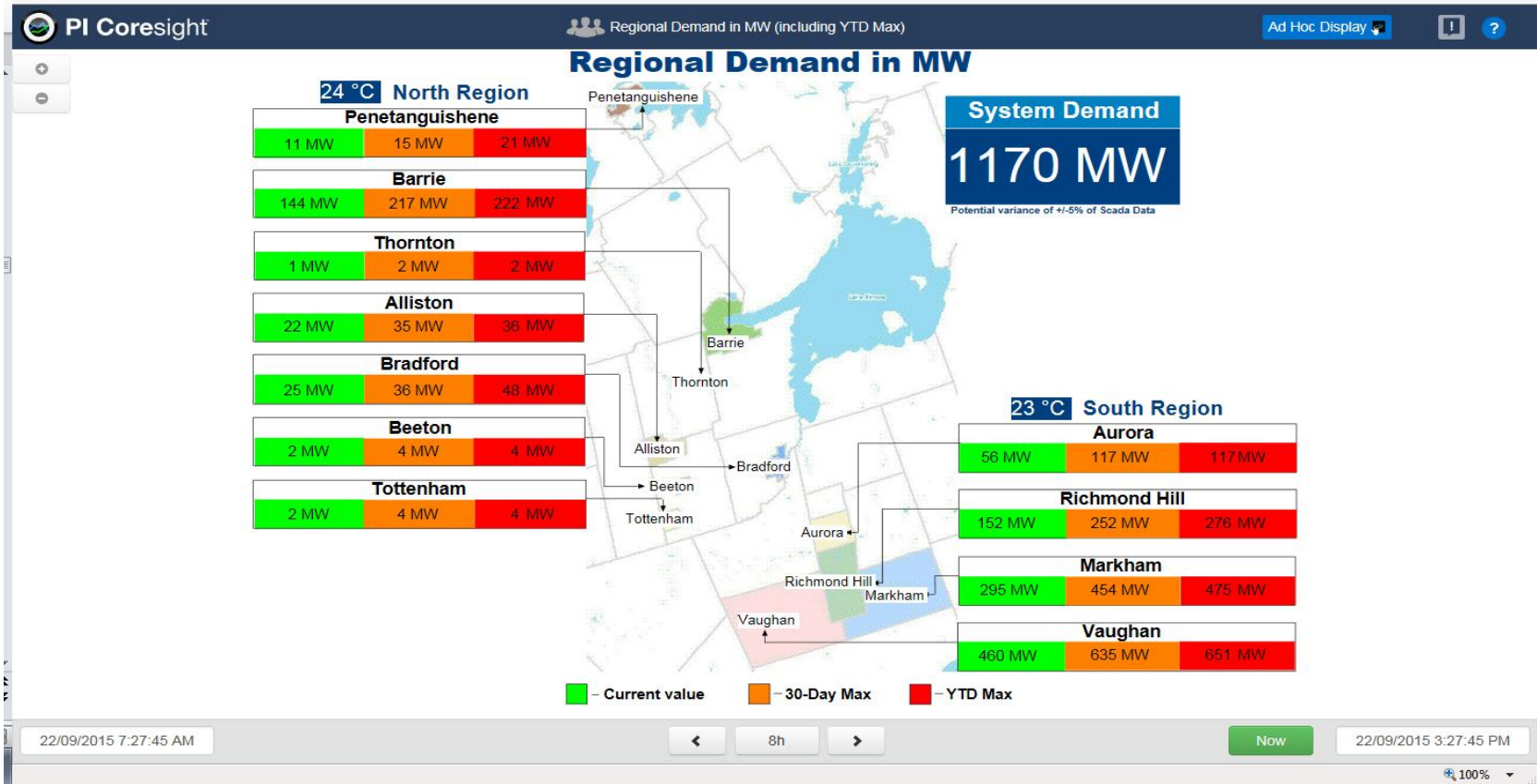
PI Coresight		
Power Stream		
Anne North MS301: T1	Saunders MS302: T1	F N
Normal		
Little Lake MS306: T1	Huron MS307: T1	P N
Normal		
Melbourne MS322: T1	8th Line MS323: T1	R N
	Normal	
14th Line MS331: T2	Patterson MS336: T1	A N
Normal		
Burton MS406: T1	Cundies East MS407: T1	C N
Normal		
Innisfil MS411: T1	Johnson MS412: T1	L N
Normal		
St Vincent MS417: T1	Wellington MS418: T1	P N
Bellis MS423: T1	Centennial MS424: T1	D N
	Normal	
05/01/2016 6:46:18 AM		
<a href="http://pspicore/Coresight/#/PBDisplays/998">http://pspicore/Coresight/#/PBDisplays/998</a>		



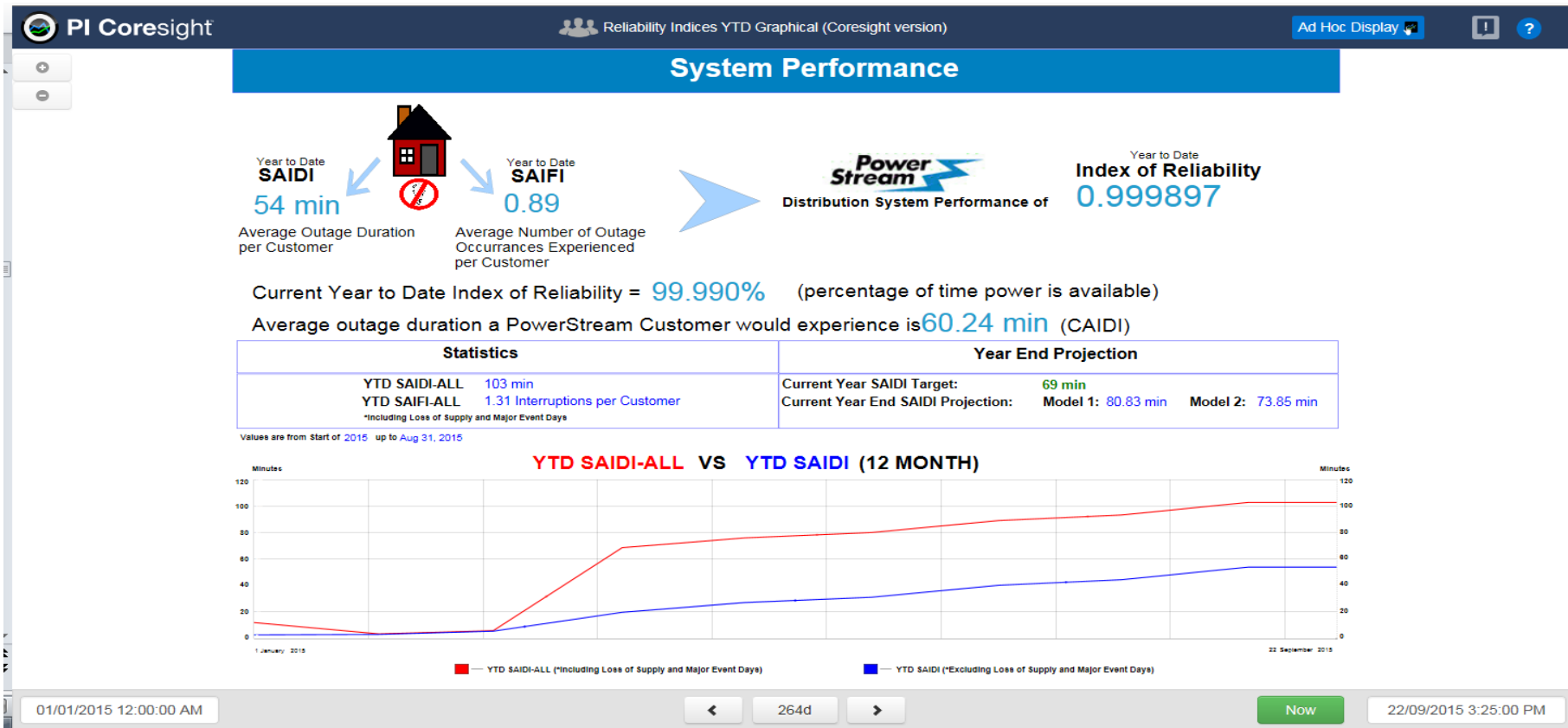
SOUTH		
Amber Amber: T2	Intellix GLA 100	
Normal		
Aurora 1 AMS1: T2		
Normal		
Aurora 3 AMS3: T1		
Aurora 4 AMS4: T1	Aurora 4 AMS4: T2	
Normal	Normal	
Aurora 5 AMS5: T2	Aurora 6 AMS6: T1	
Normal	Normal	
Aurora 7 AMS7: T1	Aurora 8 AMS8: T1	
Baythorn Baythorn: T2	John Street John: T1	
Morgan Morgan: T1	Morgan Morgan: T2	
Now 05/01/2016 2:46:18 PM		
100%		



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



# System Reliability Report using PI Coresight / PI ProcessBook



# PI Coresight - Quick and Simple Adhoc Reporting

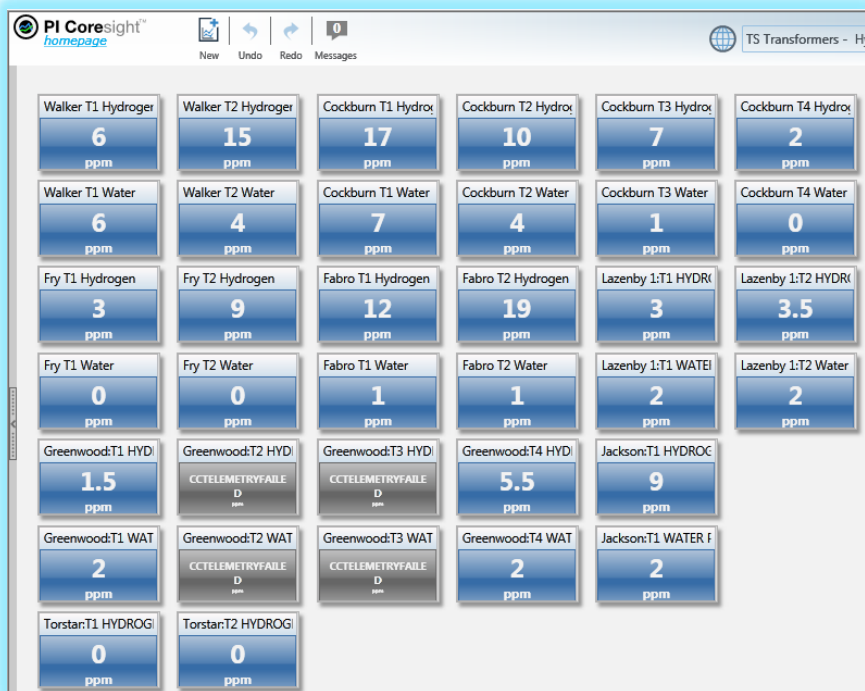
## Transformer Load (MW)



## Transformer Winding Temperature

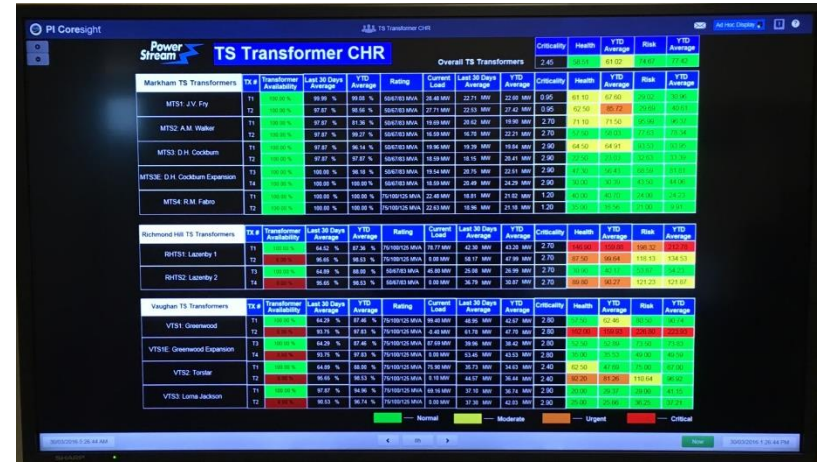


## Transformer Hydrogen and Moisture



# PITV – Operations Dashboards

- 1-65" and 4-47" flat screen TV's with wireless computer
- Installed at various locations
  - Operations Centre common areas
  - Executive office and staff area
  - Field office
- Runs a script of preselected PI reports

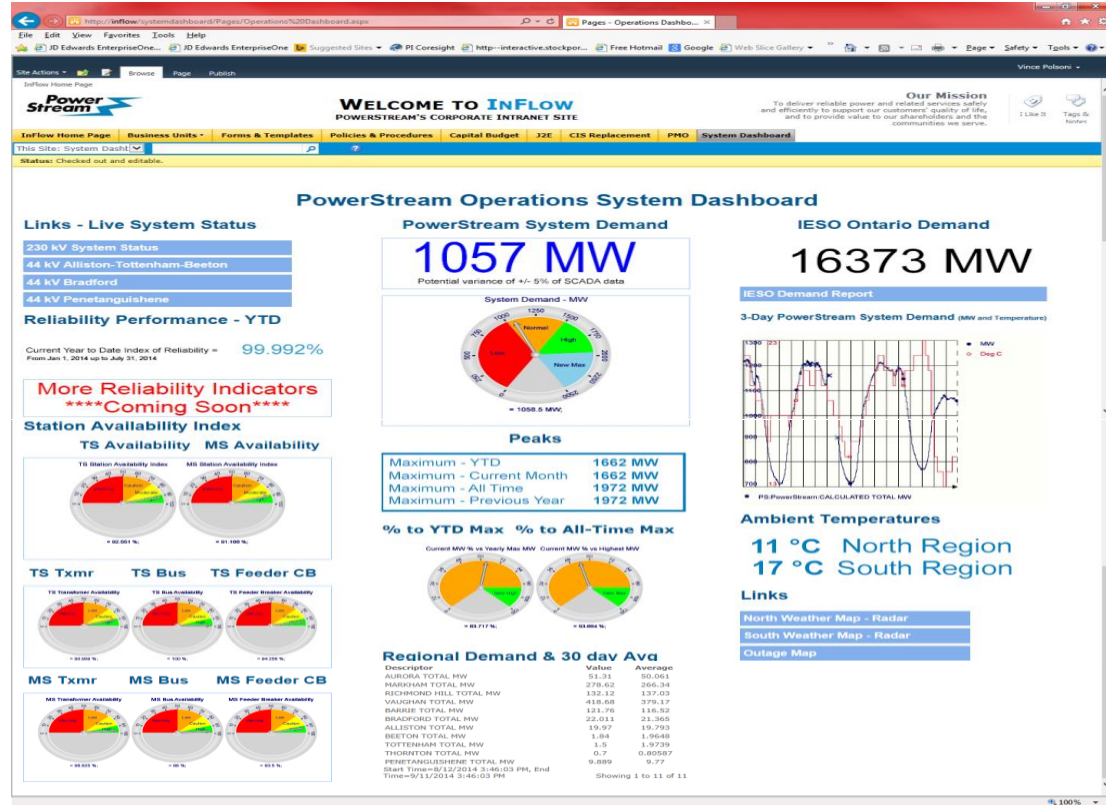


PITV

# Corporate / Operations Dashboards

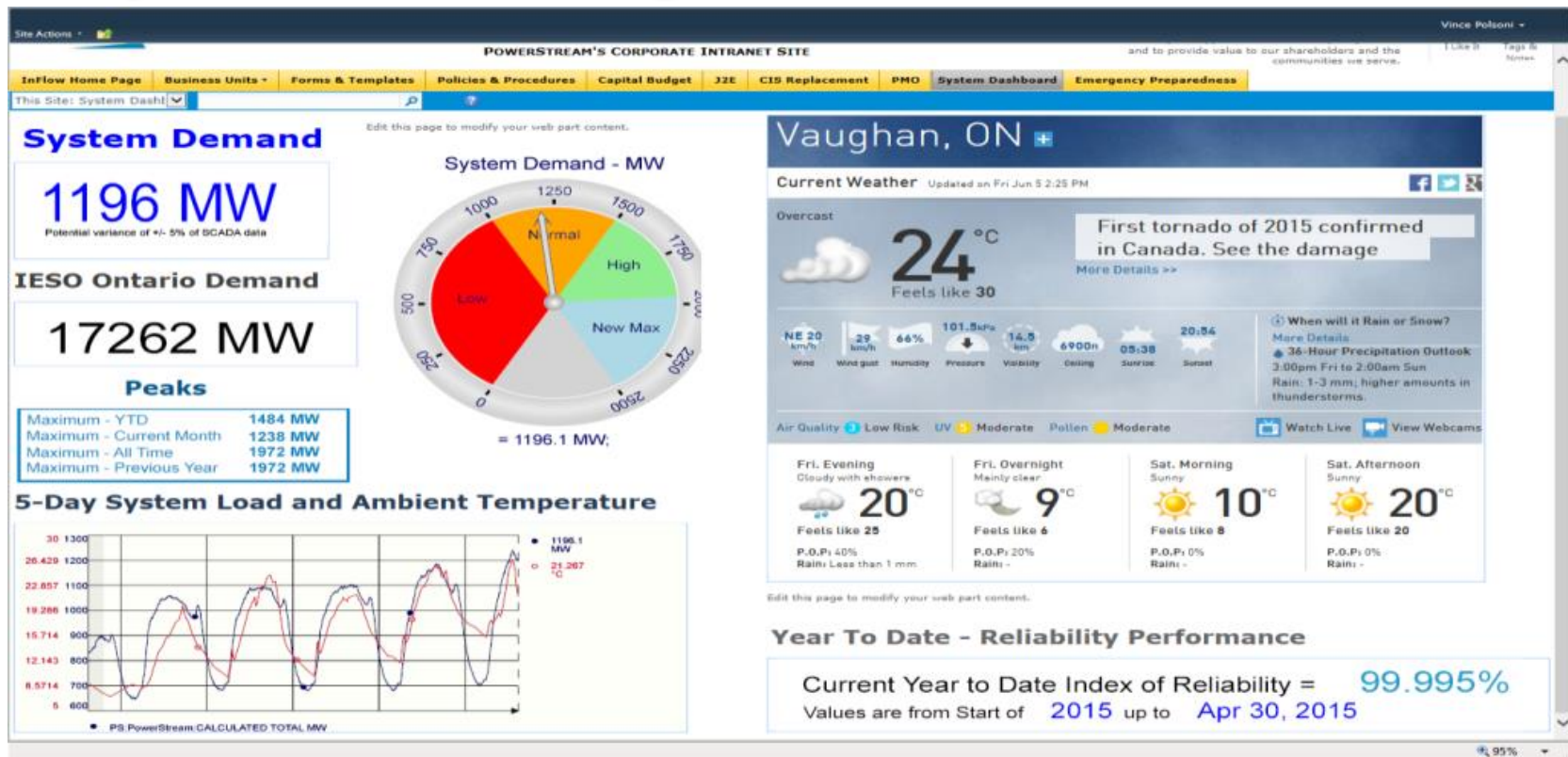


PITV – Open Area



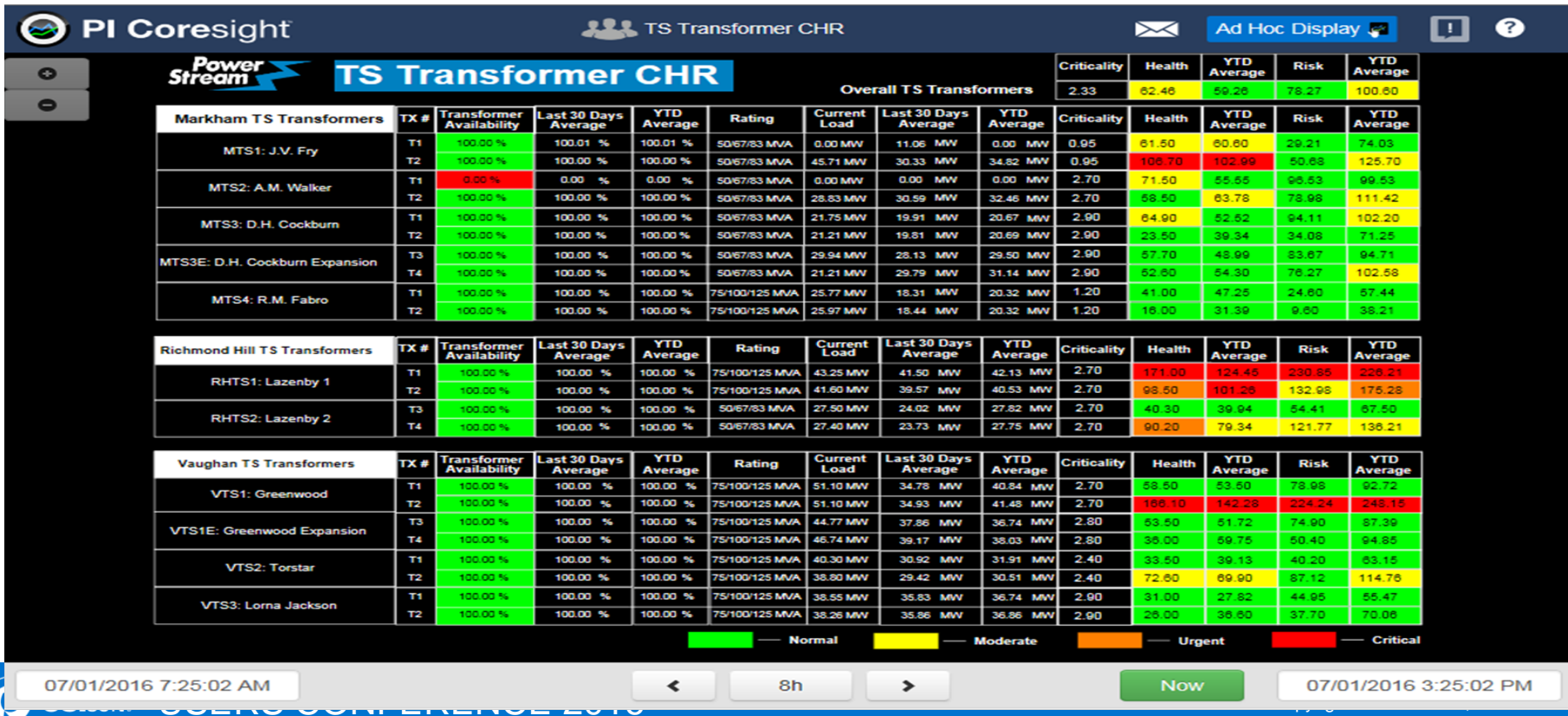


# System Loading Dashboard





# TS Transformer Criticality, Health and Risk Report



# Criticality, Health and Risk



## Criticality

- Add number of Customers
  - Station
  - Feeder (circuit breaker)
    - Include potential number of customers affected during an event in PI Notifications and reports



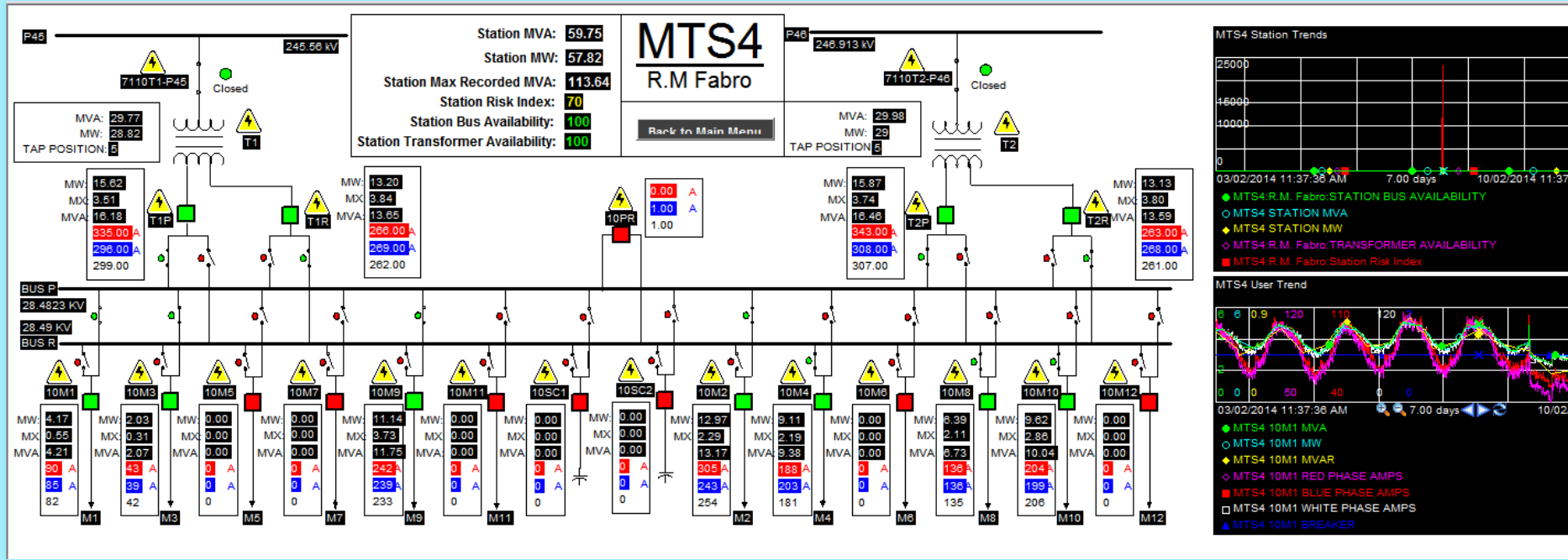
Risk



## Health

- Inputs from CMMS
  - PI Data, Inspections, Maintenance and Failures
  - From OMS to PI System to CMMS back to PI Reports

# PI ProcessBook – Station Single Line



# PI Notifications – Real-time Information

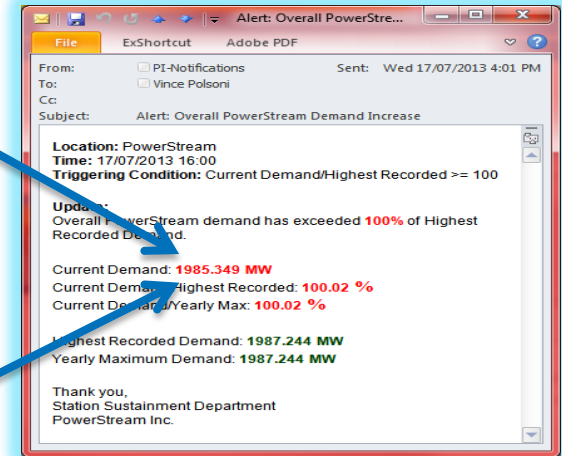
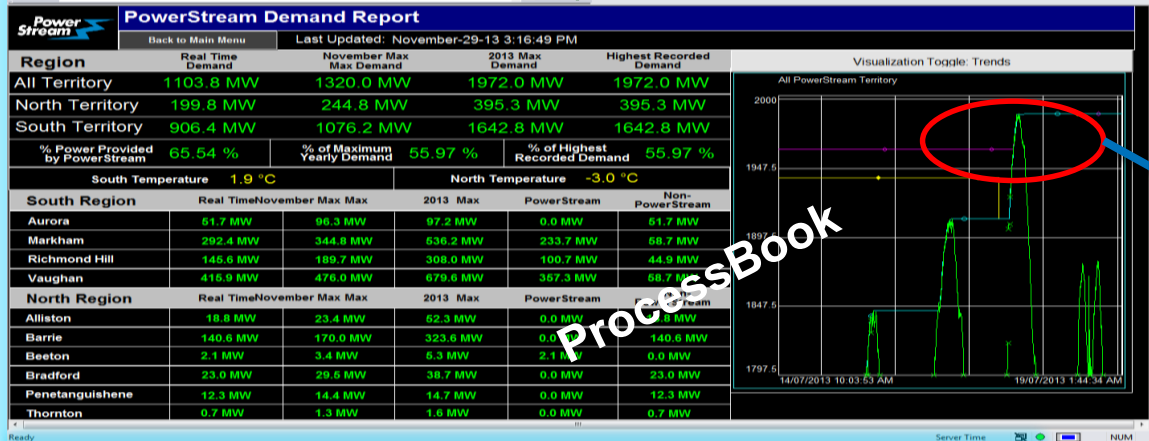


- Current Total Outages by Region
- Circuit Breaker Operation
- Low SF6 Gas
- Station Building Temp
- DC System
- Battery Low Voltage
- Calisto 9 General Alarm
- System Demand

- 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

# PowerStream 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.



Email Notifications

# SCADA – PI System – CMMS working as One

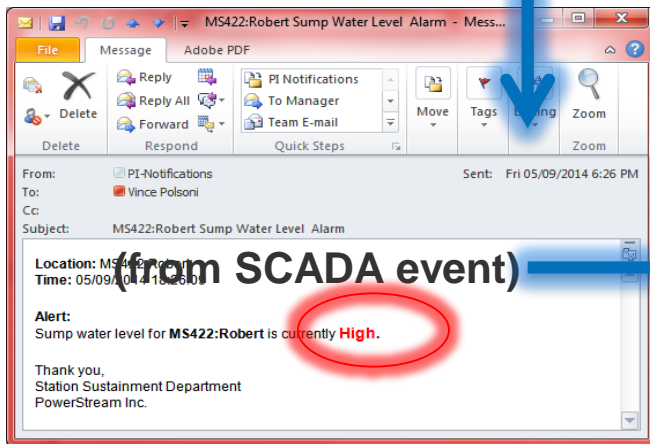
PI Report (High Water Alarm)



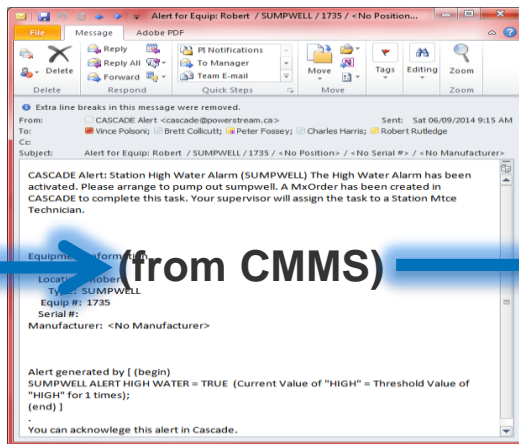
PI Report (High Water Alarm Cleared)



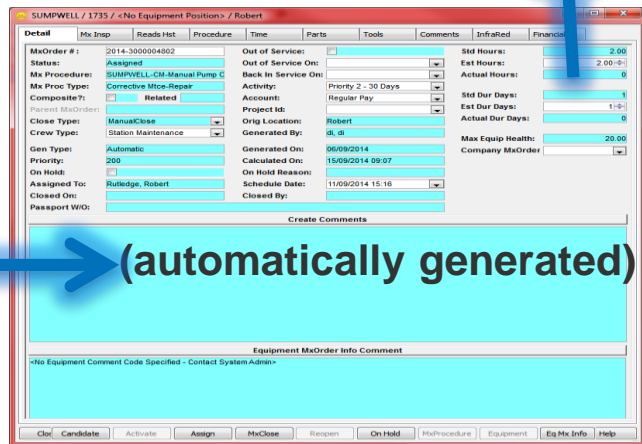
PI Notification



CMMS Alert



CMMS Work Order



(from SCADA event)

(from CMMS)

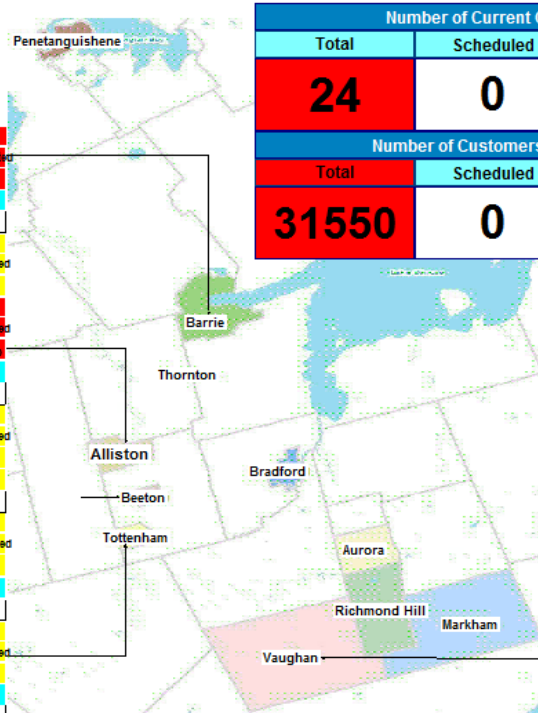
(automatically generated)



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

## Current Outage Information

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	



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

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	

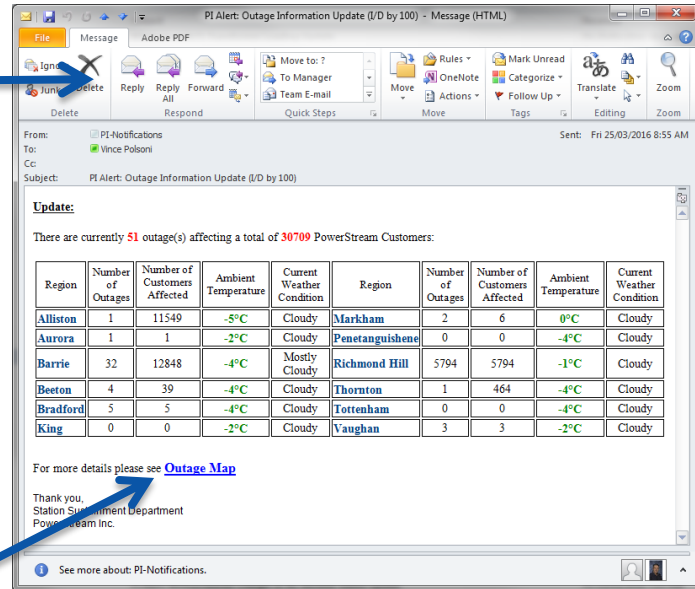
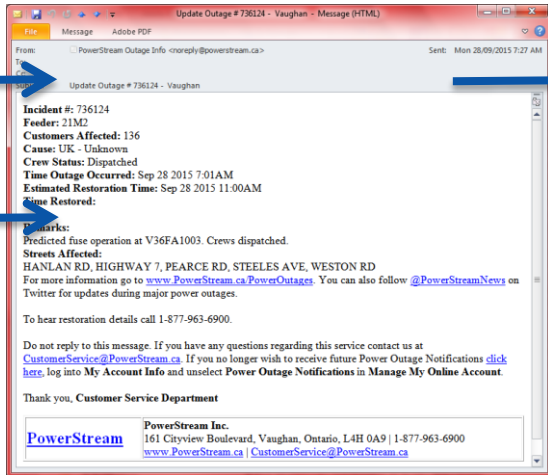
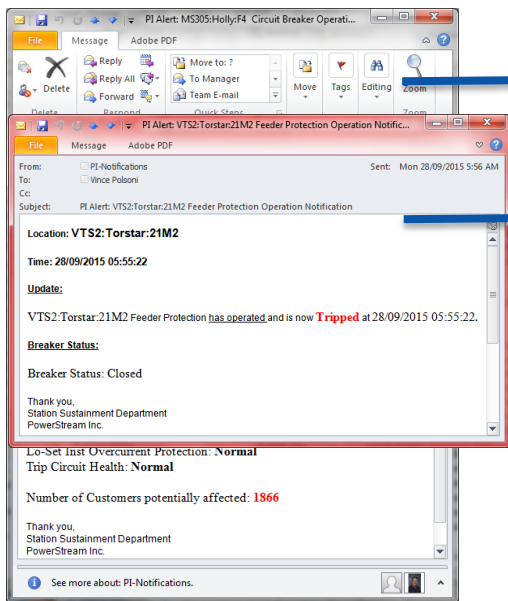
# Outage Information Flow with PI System

## PI Notifications

### Feeder Protection Trip And Circuit Breaker Operation


## Email from Outage Management System

## PI Notifications Outage Counts by Region



Link to view PI Coresight Report

# Continued Utilization of PI System at PowerStream

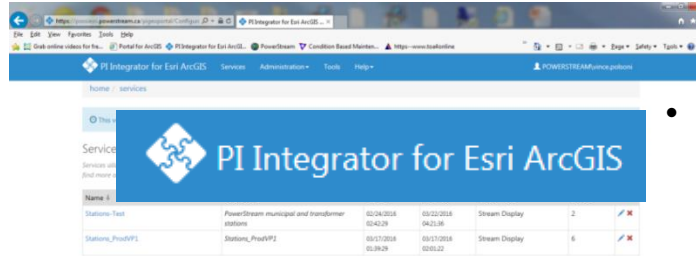
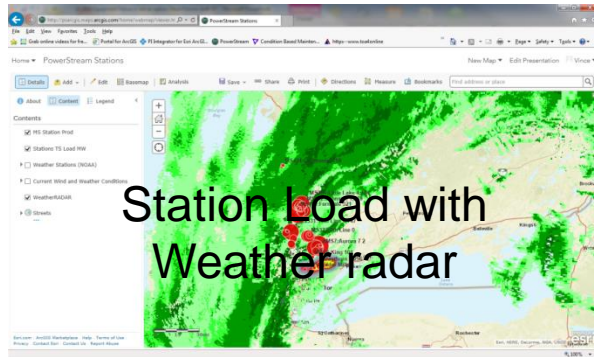
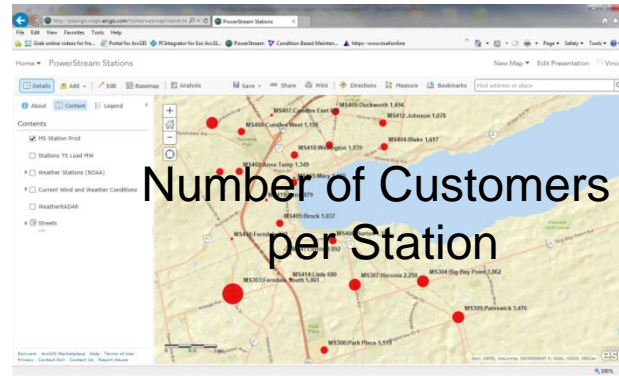
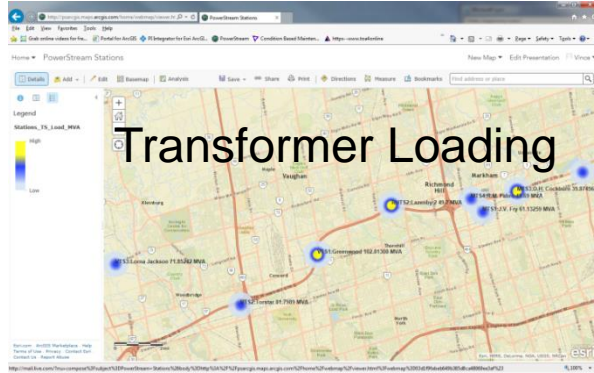
- Corporate and Operations Dashboards
- PI Integrator for Esri ArcGIS  esri
- Asset Analytics
- Failure Reporting
- Micro Grid Reporting
  - 2 Micro Grid installations
- Upcoming Merger (more opportunities)

# PI Integrator for ESRI ArcGIS

- New installation – March 2016
  - In development environment
  - Proof of concept / 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



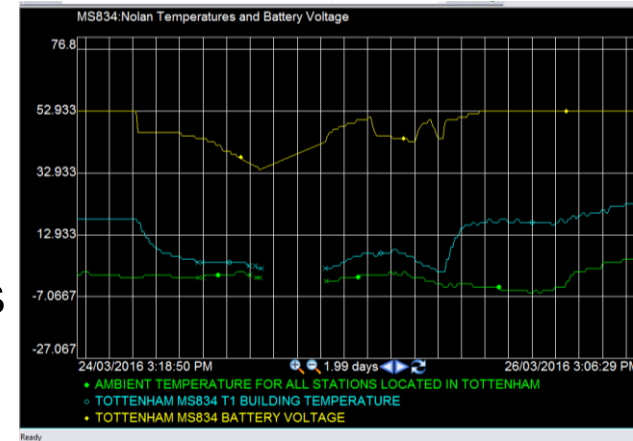
# Sample PI-ESRI Reports



- 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

# 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





# Benefits of PI System

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



# OSIsoft PI System: Equipment Failure is Not an Option

## COMPANY and GOAL

PowerStream Inc is a progressive distribution utility company that focuses on operational efficiencies in order to **optimize maintenance and minimize equipment failures.**



## CHALLENGE

Operational data only available for Control Room Operators and not available for other business units

- Data not available on corporate network
- Could not easily access data
- Archive 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 support condition based maintenance
- Developed PI Dashboards to cater to specific audiences.

## RESULTS

System and equipment condition awareness increased across complete organization.

- Improved System Reliability
- Increased Equipment Availability
- Savings in OPEX Costs

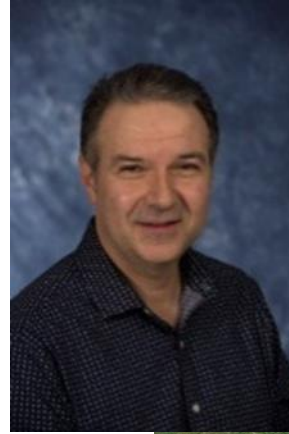
# Contact Information

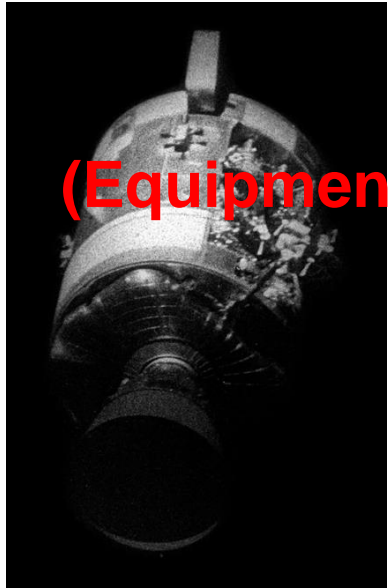
## Vince Polsoni

vince.polsoni@powerstream.ca

Manager Station Sustainment

PowerStream Inc.





**(Equipment)**

Let's get a  
PI System

I am calling  
my brother  
**Ron**

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

## Questions

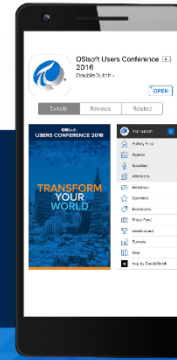
Please wait for the **microphone** before asking your questions



State your **name & company**

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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado



The background of the image is a dark blue gradient with a faint, stylized cityscape of San Francisco, including the Golden Gate Bridge and the Transamerica Pyramid. The OSIsoft logo is positioned at the top center.

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