Case Study: How Power Quality Systems are saving Electric Utilities Money

Jerry Olechiw
Vice President of Sales – Dranetz
General Manager - Electrotek Concepts

BIG DATA

Big Data Creates Predictive Maintenance Opportunities

04/15/2014

by Jim Chappell, InStep Software

BIG DATA

“Tr**ansfor**mers should be able to efficiently change transmission voltages down to lower distribution voltages, and circuit breakers should interrupt fault currents. Unfortunately, optimal operation is not always the case. Equipment becomes degraded and aged, environmental factors take their toll and assets become damaged. To counteract these issues and achieve ideal operating conditions, utilities implement equipment maintenance programs. Traditionally, these maintenance plans have been largely reactive, correcting issues as they occur; however, the exponential and continued growth of big data is creating opportunities for utilities to strengthen their maintenance plans by incorporating advanced predictive technology.”

POWERGRID INTERNATIONAL, April 2014 Edition.

ELECTROTEK CONCEPTS

Introduction

- Three examples of Electric Utilities using Power Quality Monitoring Systems to save money.

- Business cases for investment.

Where are we Today?

Jamaica is in the Caribbean Sea

Power On!

JPS

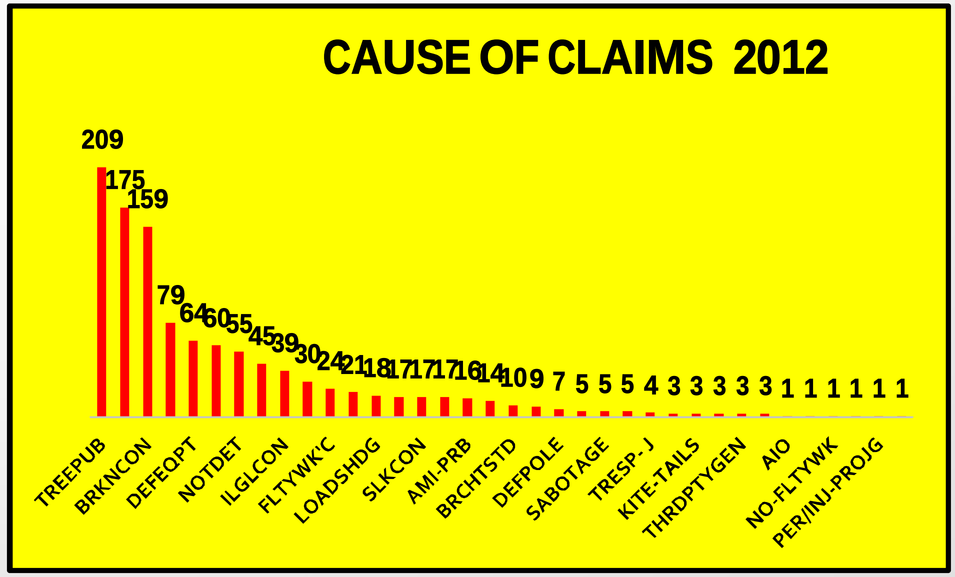
Jamaica Public Service

Power On!

Current Situation

Annual pay-out to customers from claims made against the company due to poor power quality issues.

- 2010 - $25,956,013.14
- 2011 - $17,885,845.74
- 5,496,763.17



AIO	ALL ISLAND OUTAGE
AMI-PRB	AUTOMATED METERING INFRASTRUCTURE
AON	ACT OF NATURE
BRCHGSTD	BREACH OF GUAR. STANDARDS
BRCHTSTD	BREACH OF TECH STANDARDS
BRKNCON	BROKEN CONDUCTOR
BRNTCOND	BURNT CONDUCTOR
CORR	CORROSION
CUSPRB	CUSTOMER PROBLEM
DEFEQPT	DEFECTIVE EQUIPMENT
DEFPOLE	DEFECTIVE POLE
FLTYWK'C	FAULTY WORKMANSHIP-CONTRACTOR
FLTYWK'J	FAULTY WORKMANSHIP-JPS
ILGLCON	ILLEGAL CONNECTION

MVDAM-F/D	VEHICLE DAMAGE- FALLING DEBRIS
MVDAM-F/M	vehicle DAMAGE-FALLING MATERIAL
NID	NO INCIDENT DATE
NOCONT	NO CONTACT WITH CLAIMANT
NO-FLTYWK	NO EVIDENCE OF FAULTY WORK
NOREC	NO RECORD
NOTCUST	NO CONTRACT
NOTDET	NOT DETERMINED
NOTLOC	NOT LOCATED
P/DAM - S	PROPERTY DAMAGE BY SPARKS
P/DAM-F/D	PROPERTY DAMAGE-FALLING DEBRIS
P/DAM-F/EQPT	PROPERTY DAMAGE-FALLING EQUIPT
PDR	POST DISASTER REHABILITATION
PER/ INJ-O	PERSONAL INJURY - OTHER

PER/INJ-HOLE	PERSONAL INJURY-FALLING INTO HOLE
PER/INJ-PROJG	PERSONAL INJURY-PROJECTING MATERIAL
SABOTAGE	SABOTAGE
SLKCON	SLACK CONNECTION
SLKSPAN	SLACK SPAN
THRDPTY-?	THIRD PARTY UNKOWN
THRDPTYGEN	THIRD PARTY GENERAL
THRDPTY	

TRESP- J	JPS TRESPASS ON PRIVATE PROPERTY
TRESP-PUB	TRESPASS ON JPS WORKS
VASReq	VOLATILE AREA SECURITY REQUIRED
WITHDRAWN	WITHDRAWN BY CLAIMANT
WRNGD	WRONGFUL DISCONNECTION

The Cost of Poor Power Quality - Claims

MONTHS	No. Claims Received	No. Claims Procesed	Denied	Settled	Amount Claimed	Amount Paid
JANUARY	139	124	31	33	968,331.05	665,658.56
FEBRUARY	83	204	40	43	2,912,873.44	1,638,676.00
MARCH	136	305	60	56	4,146,812.16	2,172,710.67
APRIL	81	180	9	37	1,267,854.87	883,249.00
MAY	122	223	56	28	1,368,890.16	856,909.13
JUNE	144	133	52	17	2,859,382.01	876,106.45
JULY	131	183	44	45	1,799,505.51	1,189,041.50
AUGUST	152	251	45	18	1,724,619.66	1,190,074.50
SEPT	127	159	33	31	1,685,174.37	1,261,781.78
OCT	115	148	5	48	3,489,714.95	2,192,744.11
NOV	128	276	56	52	2,857,955.14	1,560,464.47
DEC	82	187	72	36	2,281,280.38	1,009,347.00
TOTAL	**1,440**	**2,373**	**503**	**444**	**27,362,393.70**	**15,496,763.17**
			947			**57%**

JPS

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Project Scope

- Installation and configuration of PQ monitors at 7 substations which allows for the measurement of Power Quality on 18 distribution feeders.
- Installation of PQ View software, Encore software and the Master Station and other supporting hardware.
- Implementation/Integration of communication infrastructure to facilitate communication from a Master Station to the Power Quality monitors.
- Develop and implement an interface for data acquisition by existing SCADA.
- Determine requirements for data interchange between the PQMS and SCADA.

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Main Features of Power Quality Monitoring & Reporting System

- Provide near monitoring and reporting of PQ (Voltage sags & swells, interruptions, Harmonic analysis)
- Early warning of Power Quality related issues
- Extensive Power Quality parameters accurately measured for actionable data
- Highly configurable reporting and alerts

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Benefits of the System

- Ability to benchmark JPS to International Power Quality Standards
- Improved collection of Power Quality information throughout the distribution network
- Improved data collection to address customer complaints and claims
- Ability to improve reliability through event analysis and prevention
- Improved visibility on the Distribution Network
- Foundation for a smarter grid
- Improved reliability of electricity supply
- Improved information sharing with customer concerning quality of supply
- Better turnaround time to address customers claims through available information

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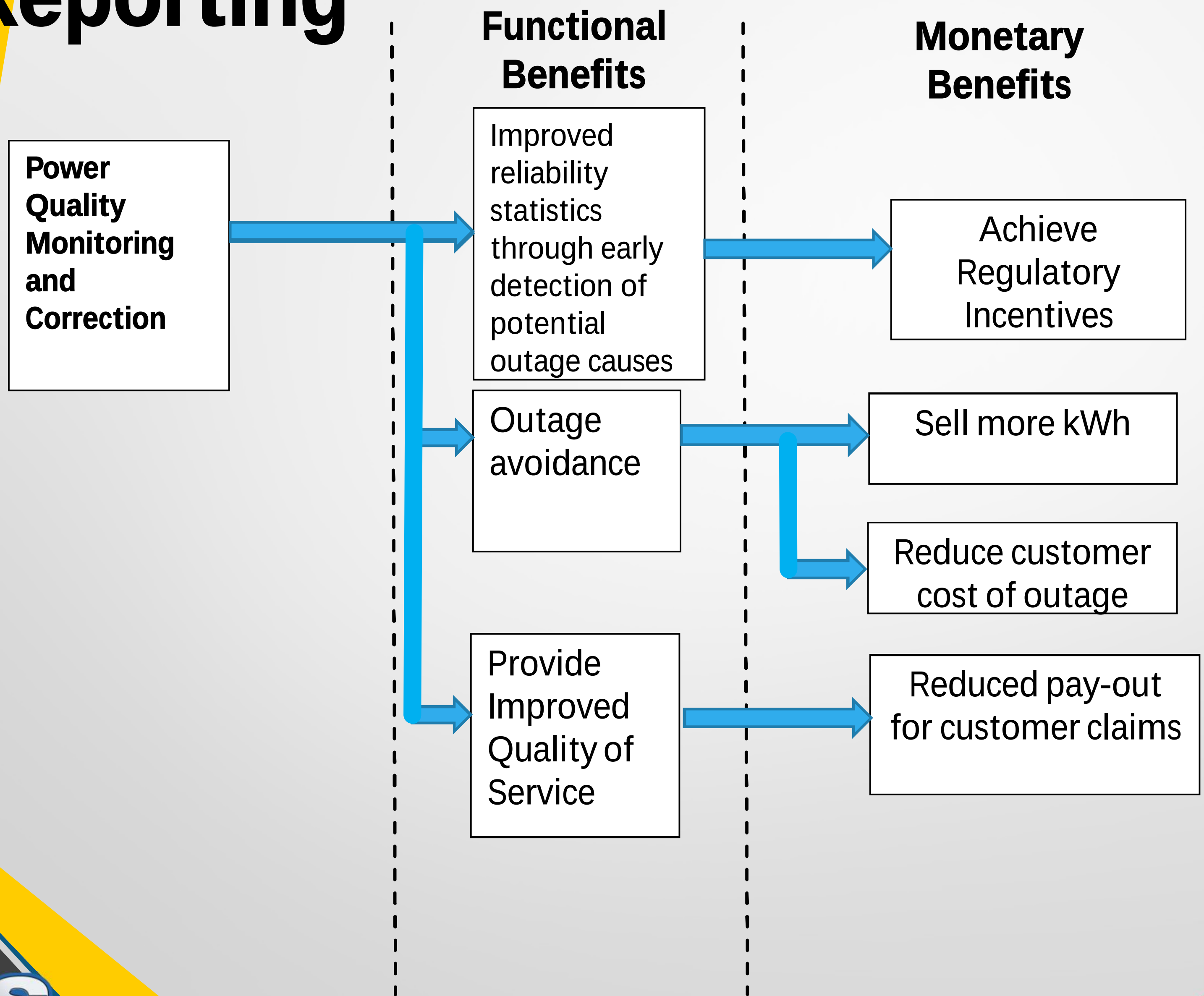
Benefits of Improved PQ Monitoring & Reporting



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GAP Analysis

- What exist today
  - 112 Itron feeder level meters install inside substations
  - Existing CT and PT infrastructure at the substations
  - Manual interrogation of meter necessary to receive PQ data (Not real time)
  - Limited storage capability for PQ enabled Itron meters
  - No management software or database to manage the data

- Future Requirements
  - Robust communication infrastructure on the distribution level using redundant communication medium to satisfy the requirements of installed intelligent devices.
  - PQ monitors installed on all Distribution feeders .
  - Real time PQ data transmission
  - Centralized Network Management Software for all PQ measurement device
  - Analytical software to process and analyse data receive form end points

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Project Stakeholders

- System Control
- System Protection
- ECS Department
- SCADA/EMS Support
- IS Department
- Engineering
- Parish Operations
- Supply Management
- Metering Department
- Business Process Department

Using PQView as an Asset Management Tool.

PQView User Group Meeting
12 December 2013
Lillestrøm, Norway

Prepared by: Gary MacLeod,
Project Manager, Power Quality Enhancement Program

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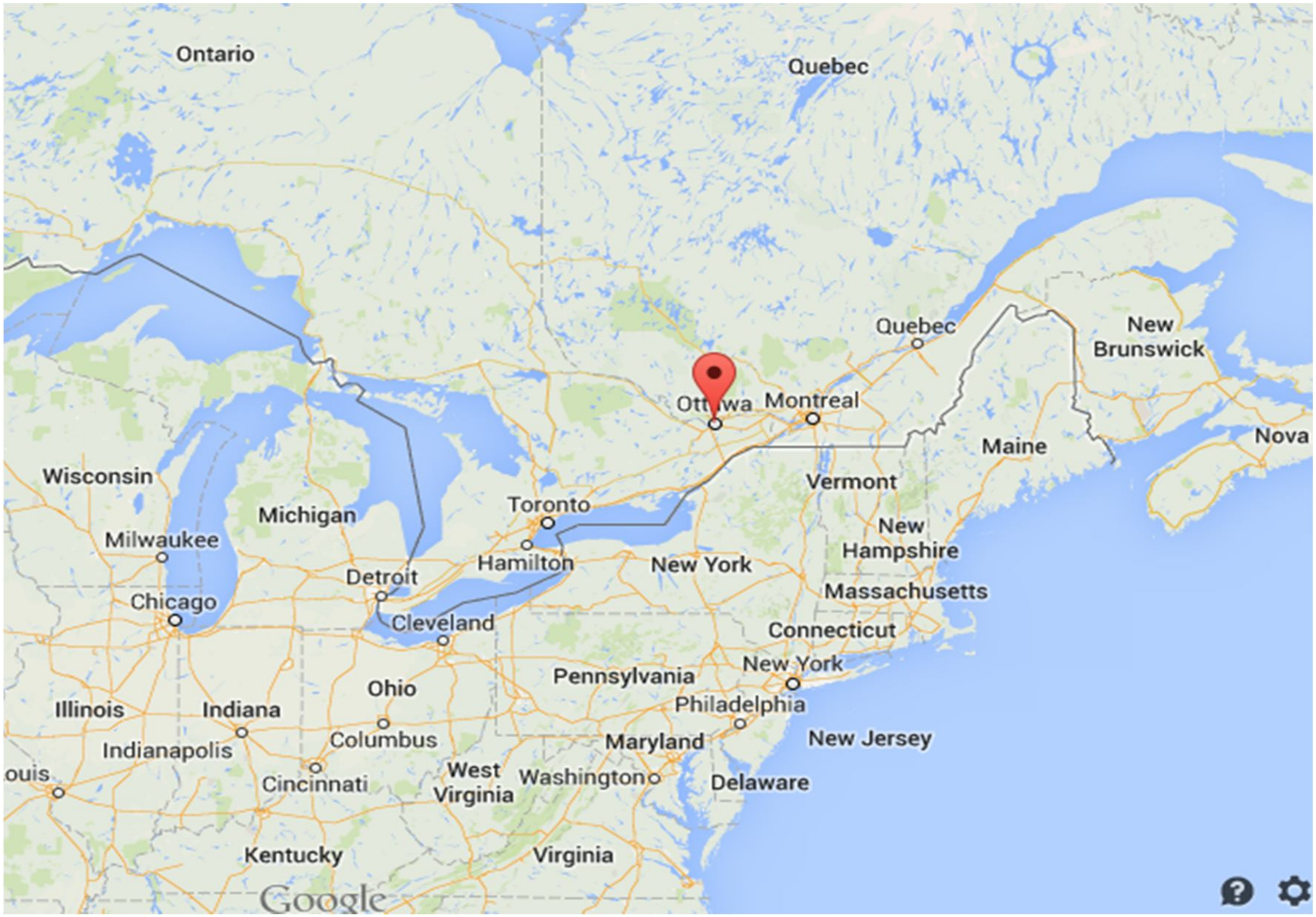
Hydro Ottawa



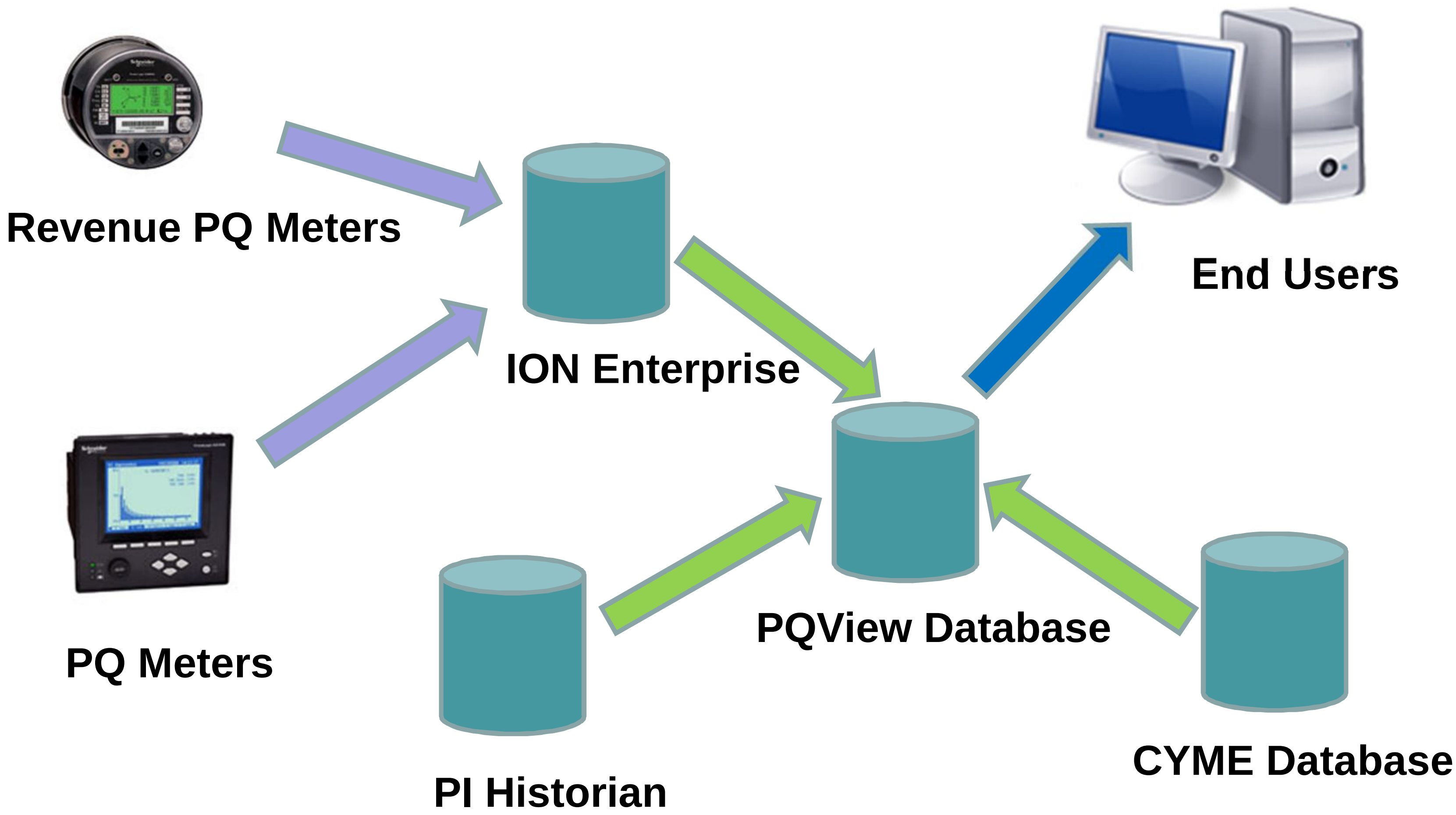
Objectives - Demonstrate how Hydro Ottawa use their fleet of ION meters, ION Enterprise and PQView to:

- Detect defective equipment before catastrophic failure
- Verifying Protection and Control settings
- Fault locate
- Provide better customer service
- Reduce customer PQ investigations
- Benchmarking PQ indices before installation of DG or new LRT

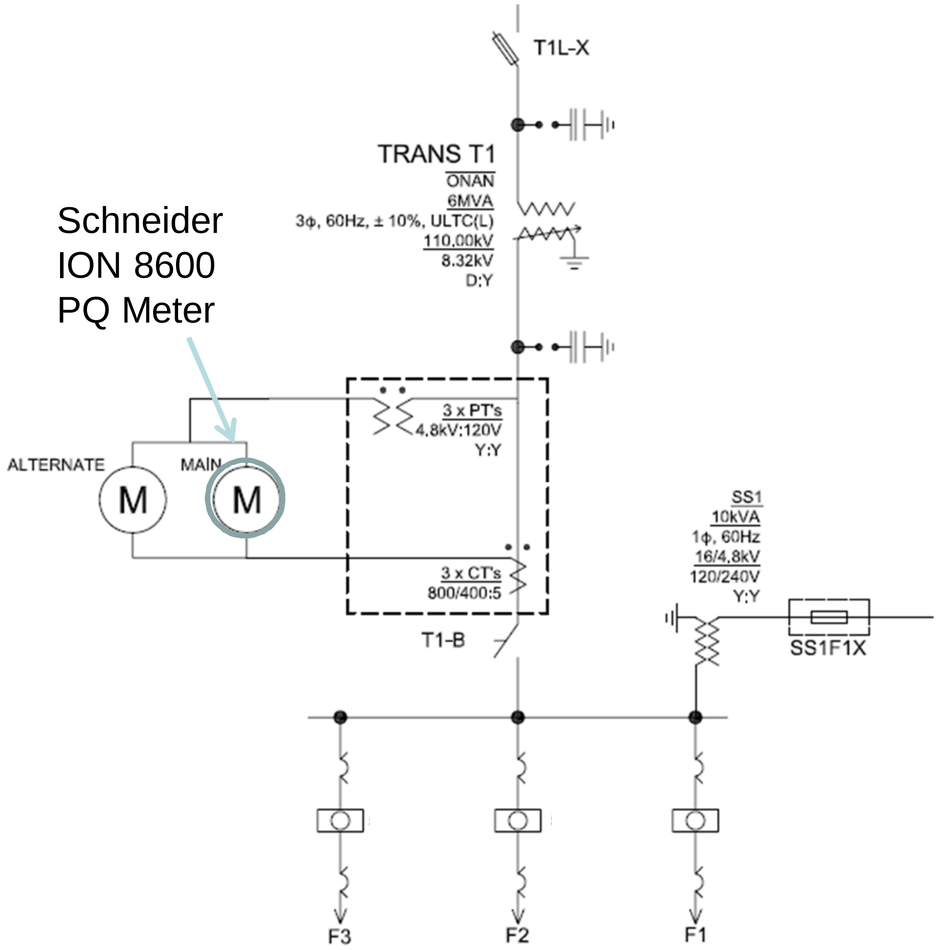
Hydro Ottawa Power Quality Monitoring

- Full-time Power Quality monitoring Using Electrotek Concept's "PQView" software and Schneider ION meters and ION Enterprise software
- We started in 2002 with a small numbers of ION 8500 meters at some of our IESO Revenue Meter Points.
- We currently have 123 PQ meters installed or planned for this year and 10 more planned to monitor all buses except 4.16kV
- Current project underway to acquire PQ data and waveform events from our SEL relays and import it into PQView
- Current project underway to use PQView and CYME for fault locating

Hydro Ottawa Power Quality Monitoring



Typical Metering Single-line Drawing



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History of Recent Tapchanger Failures

- We had three on-load tap-changers fail in past 36 months
- Transformer 1 was a 115kV – 16/27.6kV   33 MVA
- Transformer 2 was a 115kV – 16/27.6kV   37 MVA
- Transformer 3 was a 115kV – 4.8/8.3kV   6 MVA
- Different transformer manufacturers
- Two different tapchangers

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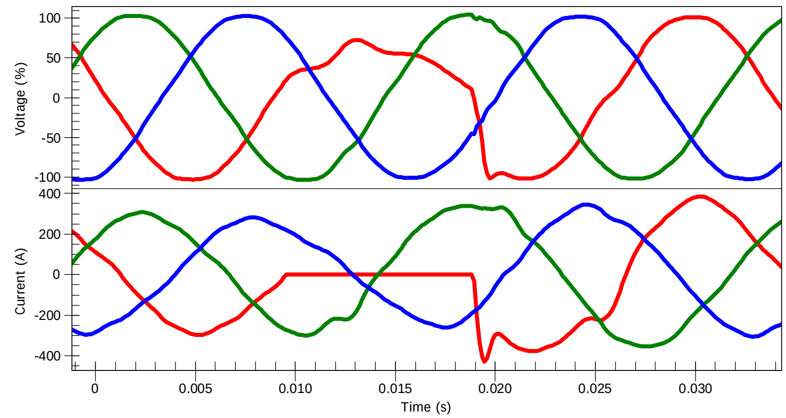
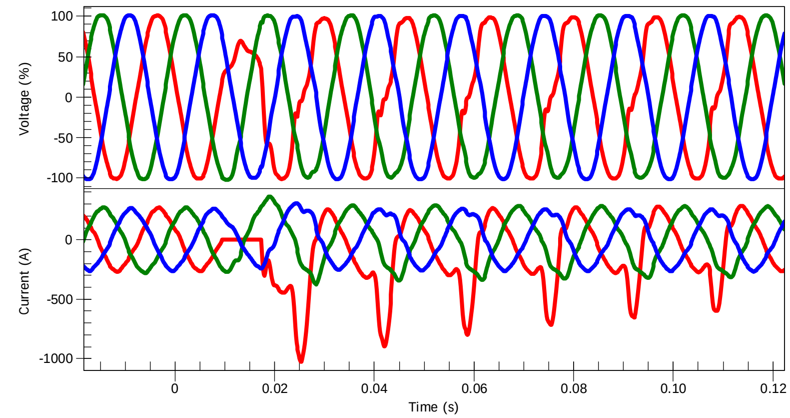
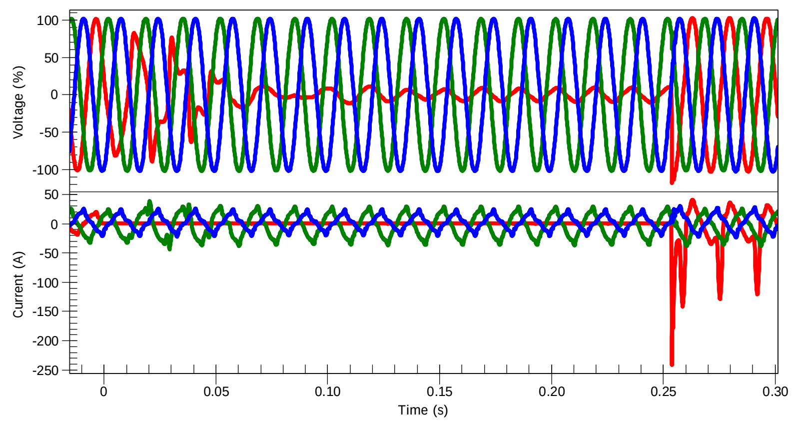
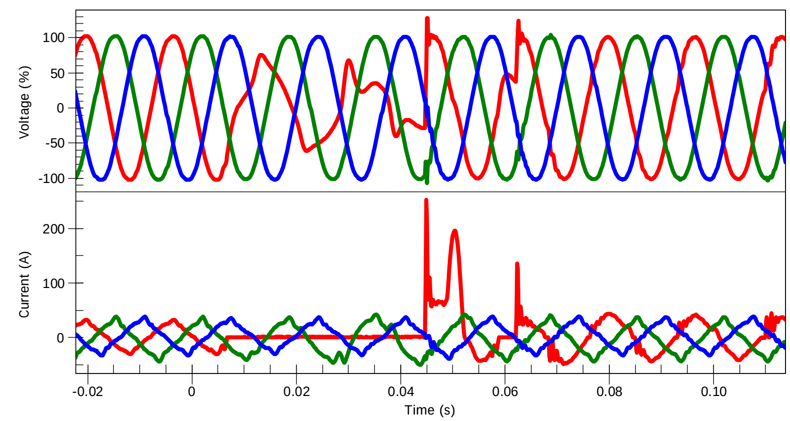
Waveforms from 1st defective tapchanger

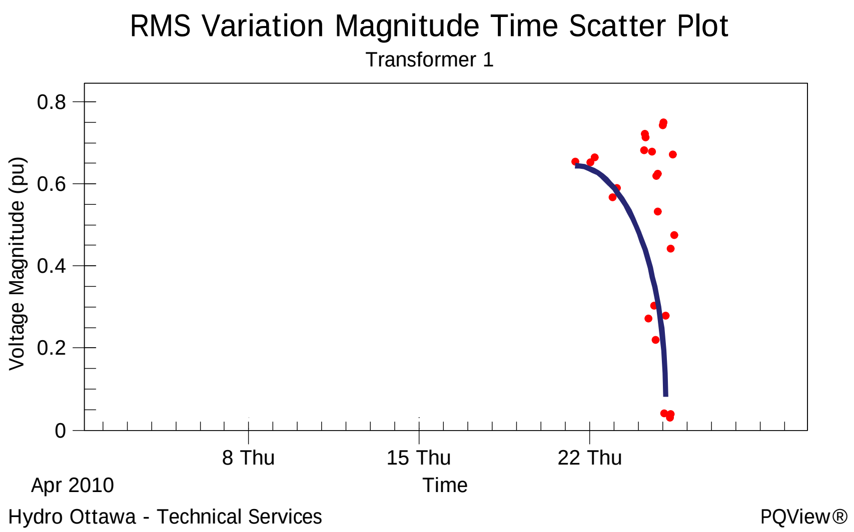


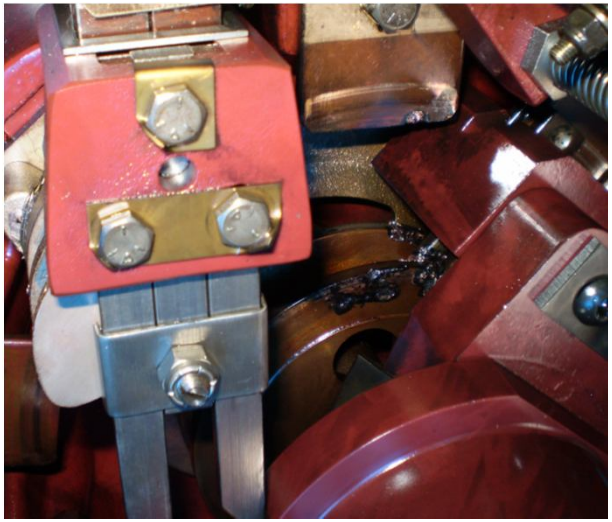


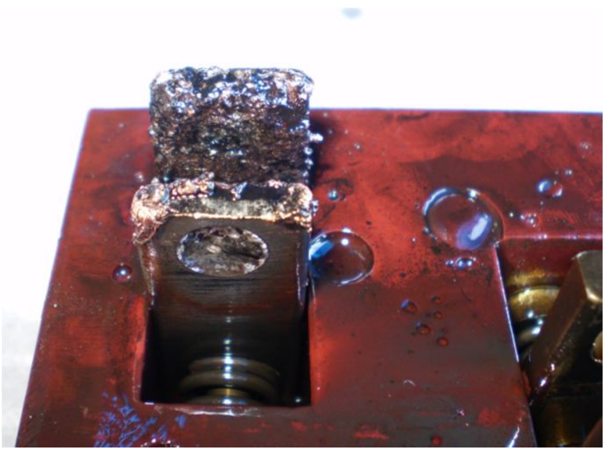




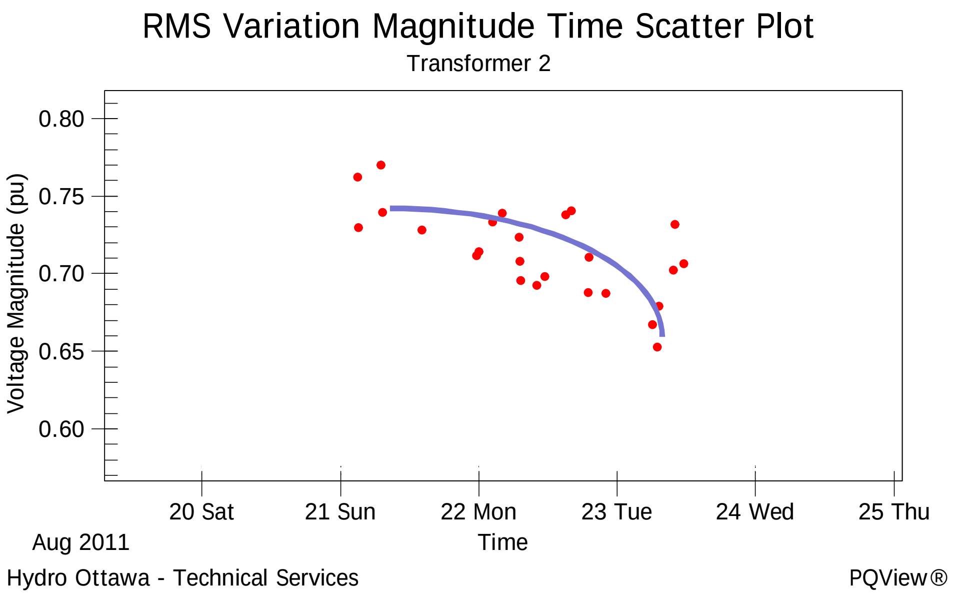
Transformer 1 RMS Variations and Damage

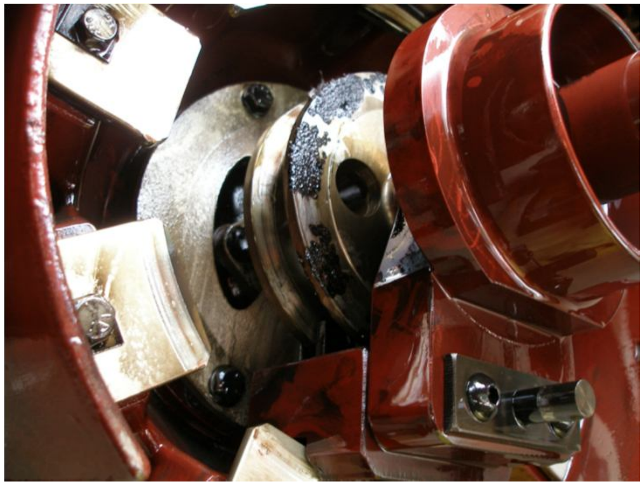






Transformer 2 RMS Variations





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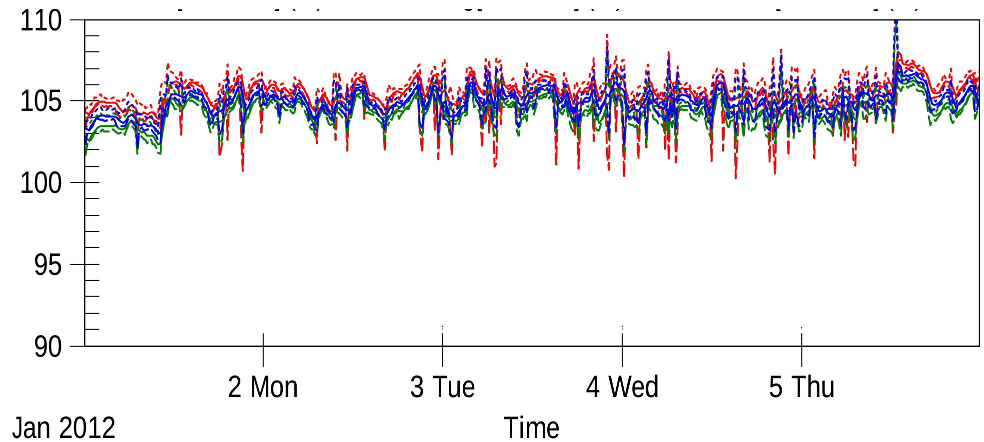
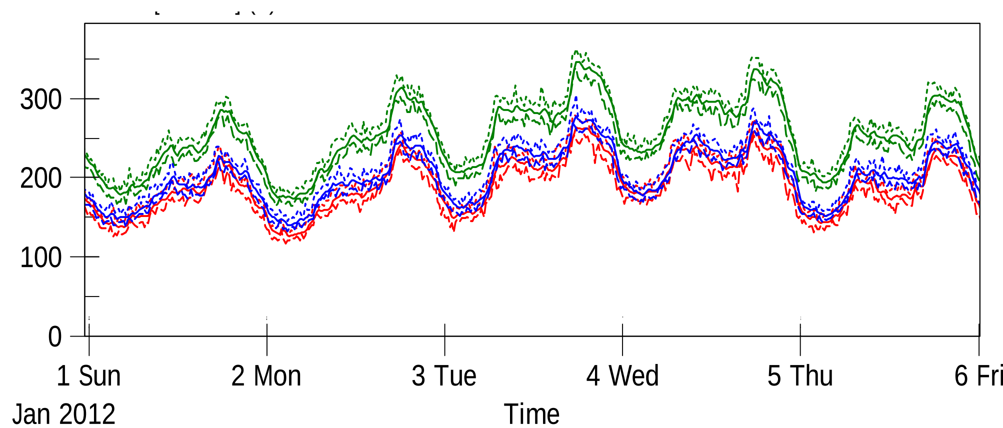
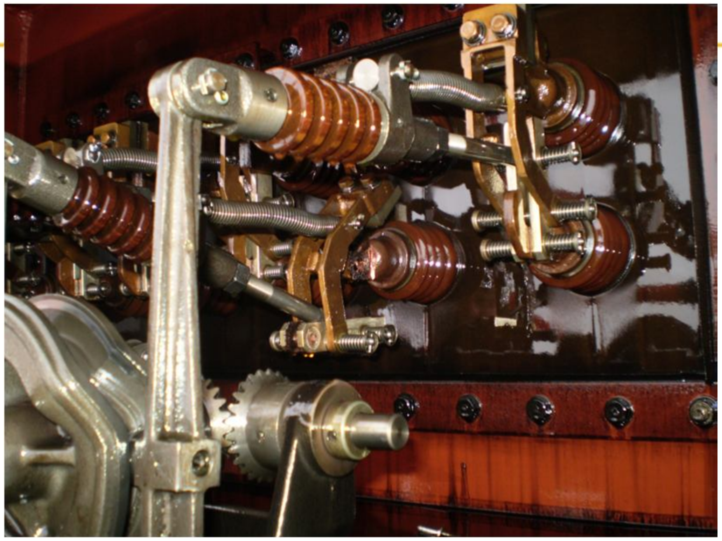
Transformer 3 "No Events"

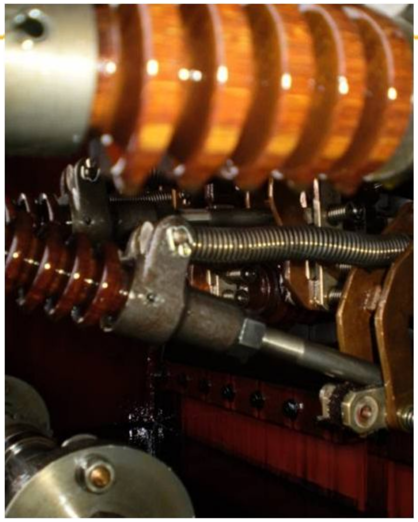
- There were no waveshape events recorded during this period.
- Voltage Trend data showed a frequent number of red phase minimum values that were not associated with current inrush or faults.
- Transformer was taken out of service and inspected and damage was found.



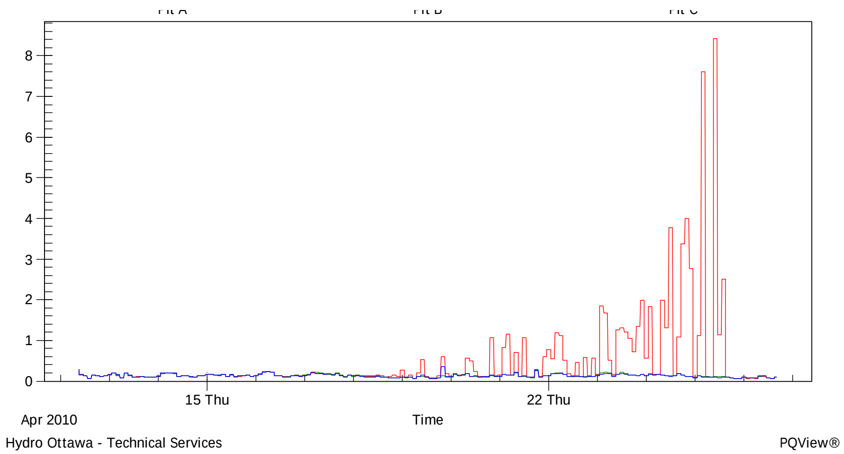


Transformer 3 Tapchanger Damage

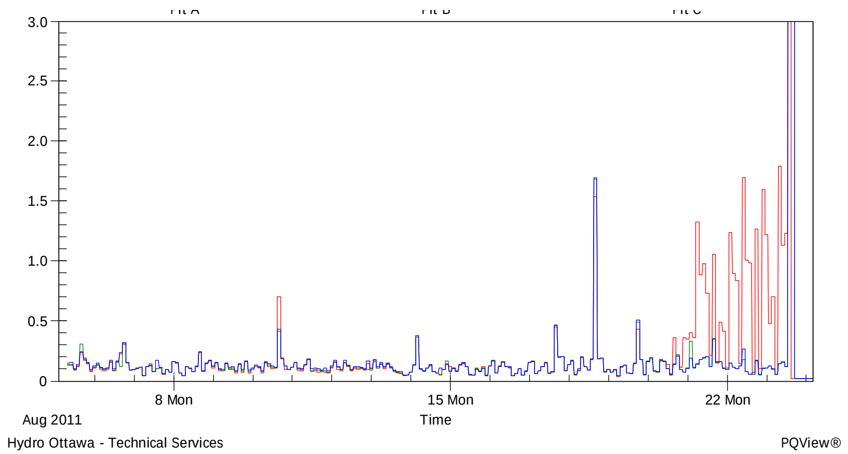




Voltage PLT Flicker Trends

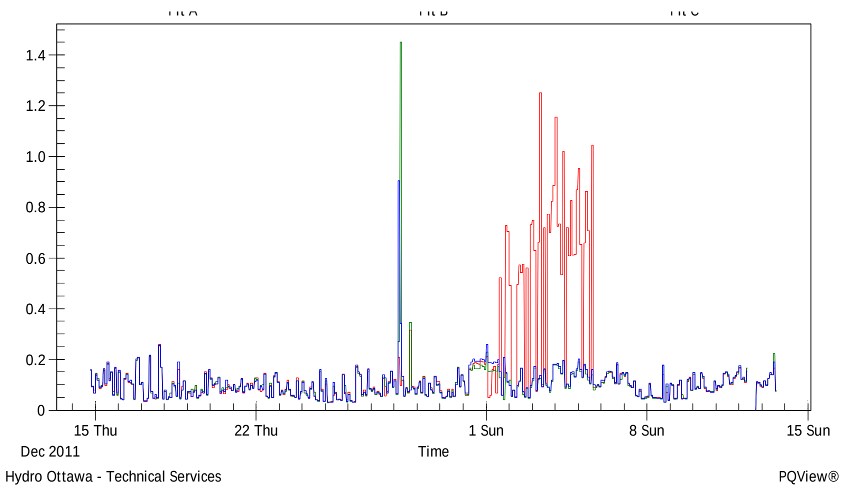


Transformer 1



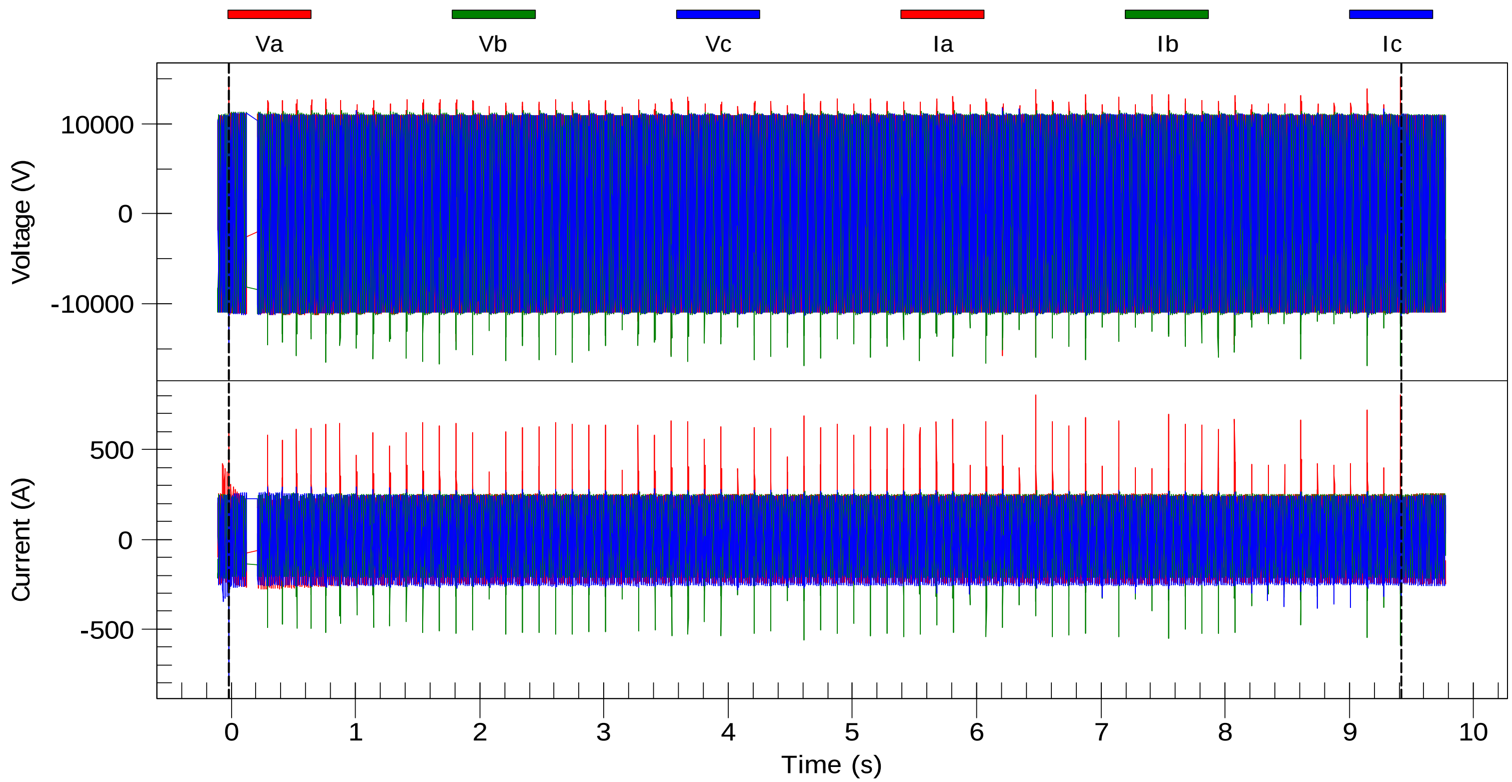
Transformer 2

PST and PLT flicker data identified the start of the **serious** damage to the tapchanger within hours on all three transformers.



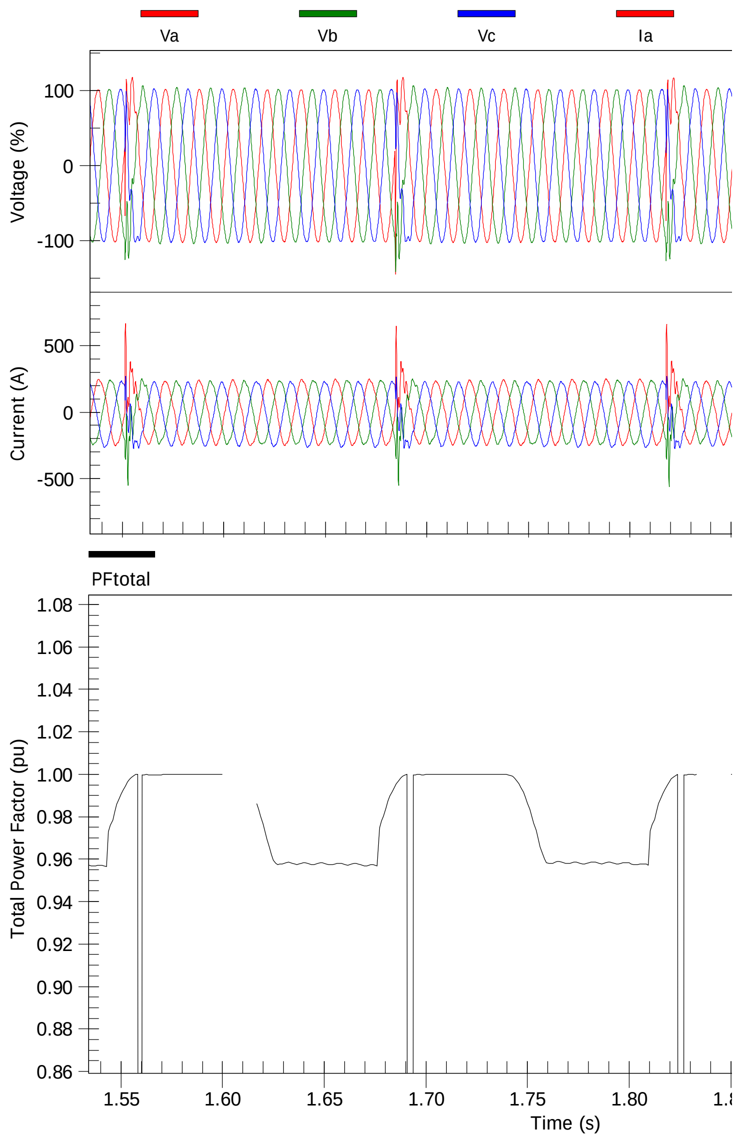
Transformer 3

Failed Operation of New Capacitor Bank



The Capacitor Bank switched in and out seventy times in ten seconds. Engineering staff and control manufacturer believed this could not happen and the meter was erroneous.

Failed Operation of New Capacitor Bank Confirmed

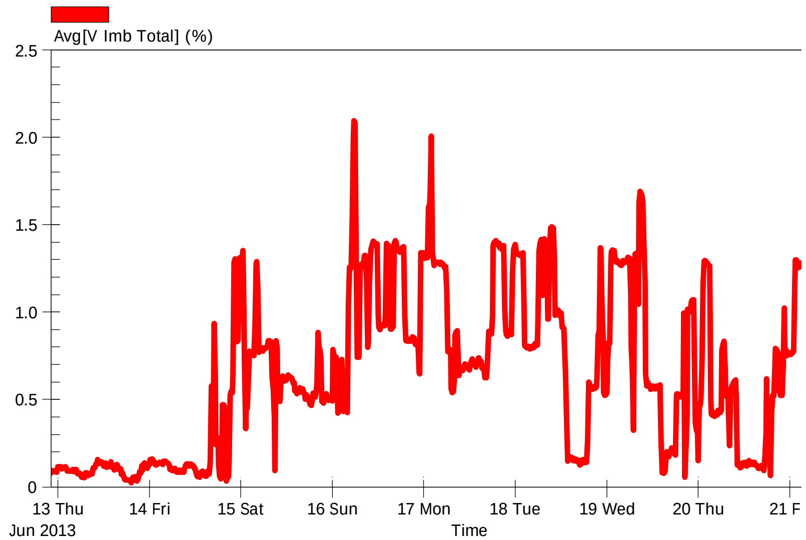


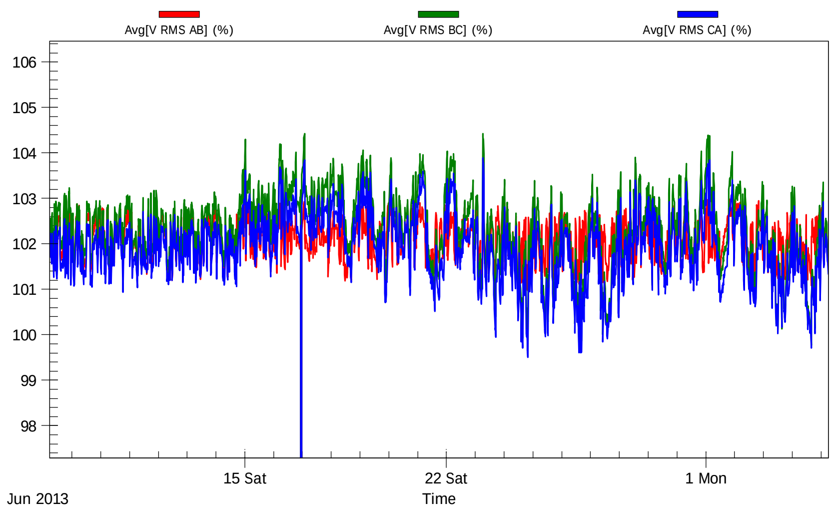
In this substation, both buses are in parallel and both ION meters saw the same event and SCADA told us the breaker operated a number of times

The graph below is shows the power factor is fluctuating between events and leading for a few cycles after the event and then dropping back to 0.96

Our engineering staff and the manufacturer are now investigating further to determine the cause

Transformer Voltage Imbalance Problem





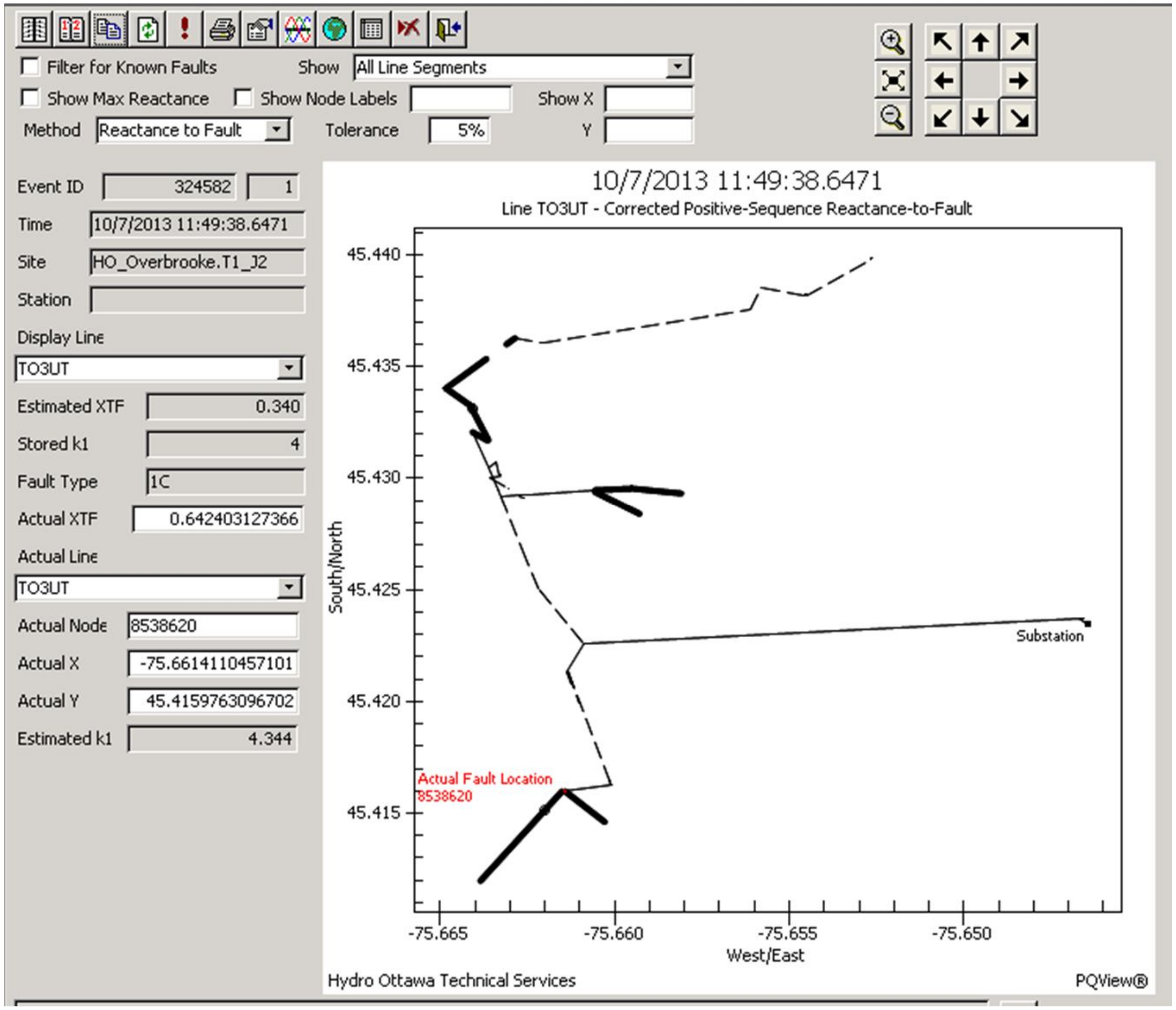
In June this year, a substation ION started to indicate increased voltage imbalance on a transformer bus.

The phase-to-phase voltage graph below did not indicate anything significantly abnormal

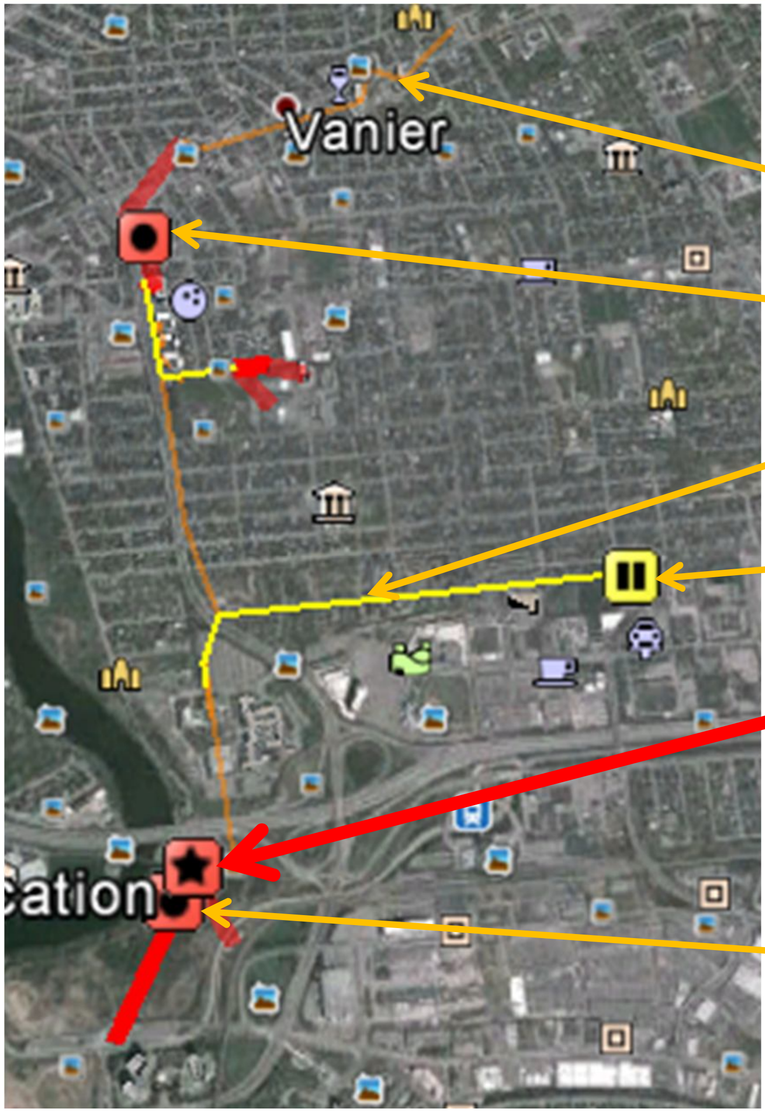
Problem was a broken chain on one phase in a tap-changer only allowing two phases to be regulated and the over fluctuated with the 115kV supply

Recommendation: Setup 3 phase- 4 wire wye ION meters to measure phase-to-neutral voltages rather than phase-to-phase. This can be done after a meter is locked and sealed as well.

Using PQView and CYME for Fault Locating



Using PQView and CYME for Fault Locating



As Shown on Google Earth

Orange line is UG cable

Predicted fault locations

Yellow line is overhead section

Substation

ACTUAL FAULT LOCATION

Predicted fault location

"Big Data"

Meter Location	V RMS Avg LL			V Imbalance		V THD A		Flicker PLT A		I THD A		I Imbalance		SARFI Count by Site				
	Min	Avg	Max	CP95	CP99.5	CP95	CP99.5	CP95	StdDev Max	CP95	CP99.5	Avg	CP95	ITIC	SARFI-90	SARFI-70	SARFI-50	SARFI-10
Meter 1	100.2	101.0	101.9	0.4	0.4	1.2	1.6	0.3	0.5	4.0	4.9	1.1	1.4	0	1	0	0	0
Meter 2	99.5	100.4	101.5	0.4	0.4	1.7	1.9	0.3	0.5	4.5	5.1	1.4	1.7	0	1	0	0	0
Meter 3	100.1	101.0	101.9	0.3	0.3	1.2	1.6	0.3	0.5	4.3	5.2	1.4	1.8	0	1	0	0	0
Meter 4	99.5	100.4	101.5	0.4	0.4	1.7	1.9	0.3	0.5	4.7	5.2	1.8	2.2	0	1	0	0	0
Meter 5	98.7	99.9	101.0	0.6	0.6	2.0	2.9	0.2	0.5	1.6	1.7	1.0	1.7	0	1	0	0	0
Meter 6	98.7	99.9	101.0	0.4	0.5	1.9	2.8	0.2	0.5	1.4	1.6	1.7	2.5	0	1	0	0	0
Meter 7	98.5	99.7	101.0	0.2	0.3	1.9	2.1	0.2	1.9	2.5	3.0	2.1	2.7	1	3	1	1	0
Meter 8	99.5	100.8	102.0	0.4	0.4	1.8	2.2	0.2	0.5	4.3	5.8	0.7	1.2	0	1	0	0	0
Meter 9	98.5	99.7	101.0	0.2	0.3	1.9	2.1	0.2	1.9	2.5	3.0	0.9	1.4	1	3	1	1	0
Meter 10	99.5	100.8	102.0	0.4	0.5	1.8	2.2	0.2	0.5	4.2	5.7	0.7	1.2	0	1	0	0	0

Databases now contain large amounts of data and the challenge is to be able to use the data to find and repair trouble spots quickly.

This spreadsheet shows 10 sample sites with monthly critical statistics for August 2013. The cells are condition formatted and quickly highlight trouble spots that should be reviewed.

The two Flicker measurements highlighted in red and found that they only exceeded normal limits during a storm event and therefore deemed these anomalies acceptable and highlighted the cells with a green box

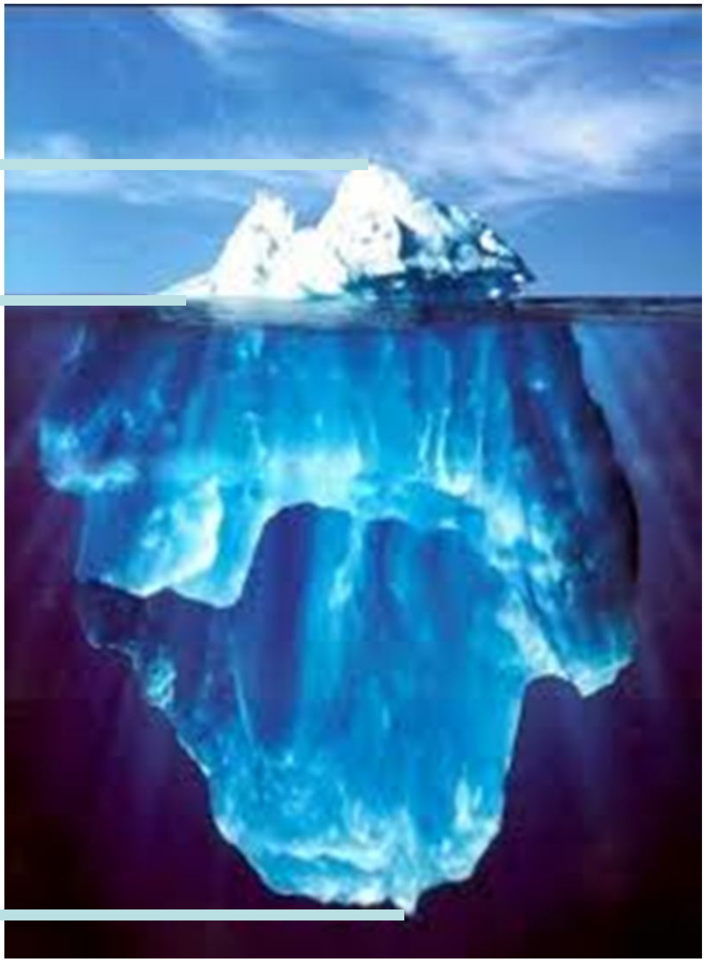
Using Big Data…

Fault locations shaded by age. Brightest are the most recent

Recent lightning strike correlates with known fault location and auto-relocate

Rash of events in same area
Trees?
Bad insulators?
Large population of squirrels?

PQ Data Use and Future Potential



Basic Functionality Now

Future Potential

- Relay Integration
- OMS Integration
- Automated Reporting
- Standards Compliance
- Predictive Maintenance
- Fault Locating
- Event Alert

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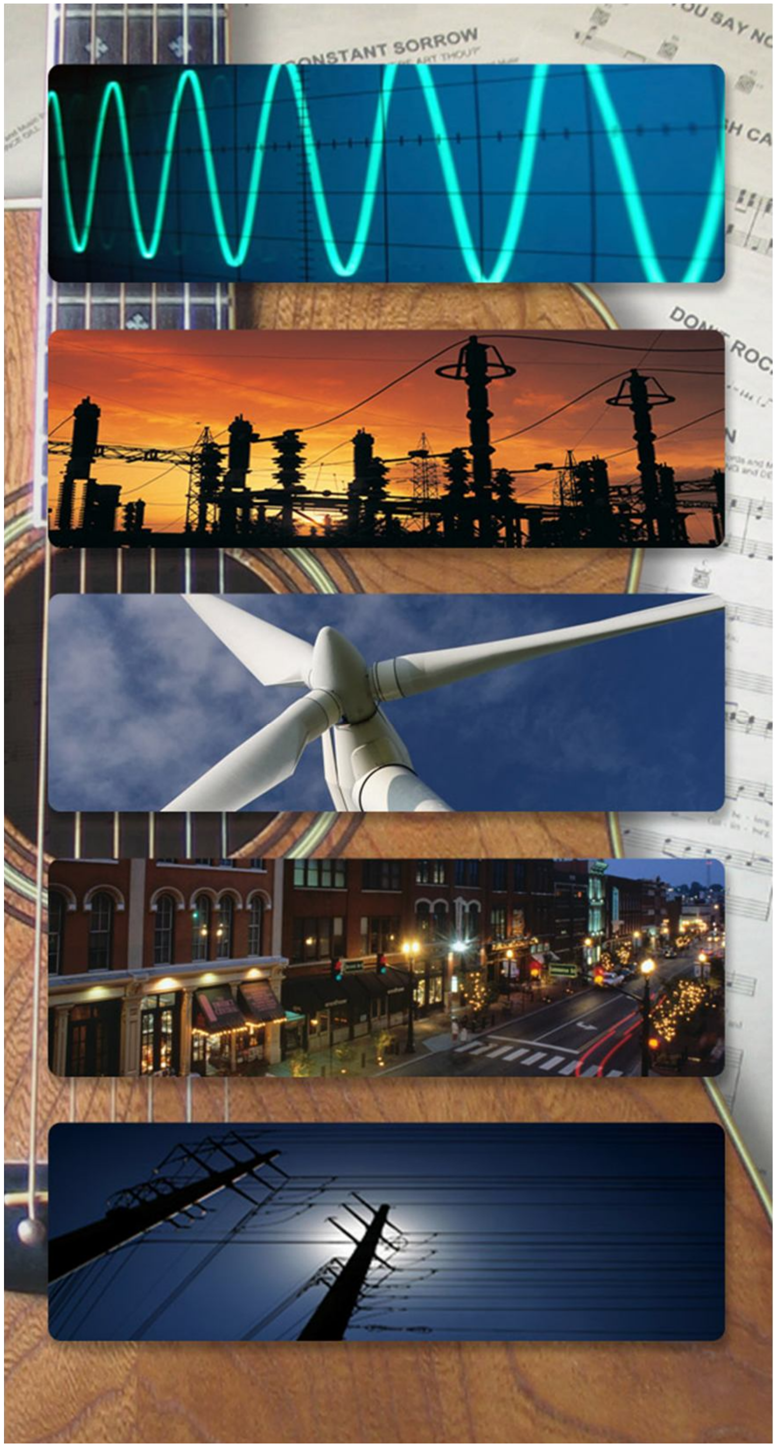
$100,000's were saved by avoiding Failure of Equipment



Federation of PQ Monitors with a SCADA Historian for Regulation Assessment of Voltage and Reactive Power

Cristiana Dimitriu and Pete Hofmann

Consolidated Edison Company of New York, Inc.

Dan Sabin

Electrotek Concepts

EPRI Power Quality and Smart Distribution 2011 Conference

Tuesday, August 16, 2011

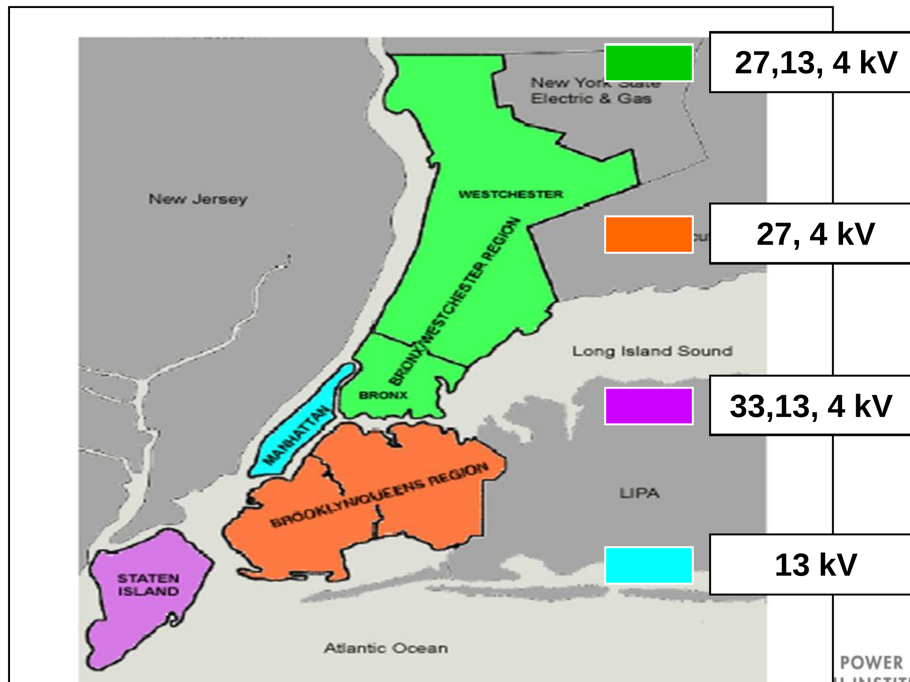
conEdison, inc.

Con Edison Company of NY

- New York City & Westchester
- 3.2 million electric customers
- System peak load 13141 MW

Distribution System

- 58 Distribution Substations
- 59 Secondary Networks, and Non-network load pockets
- 2124 Distribution Feeders
- 86% System is underground



Area Substation Voltage Control

Area Substation Voltage Control

- MW Load Versus Voltage Schedule
  - Tolerance based on time of day and day of week
- Range of Values across Transformers Operated in Parallel
  - Tap Position Spread
  - Reactive Power Balance

Area Substation Voltage Control

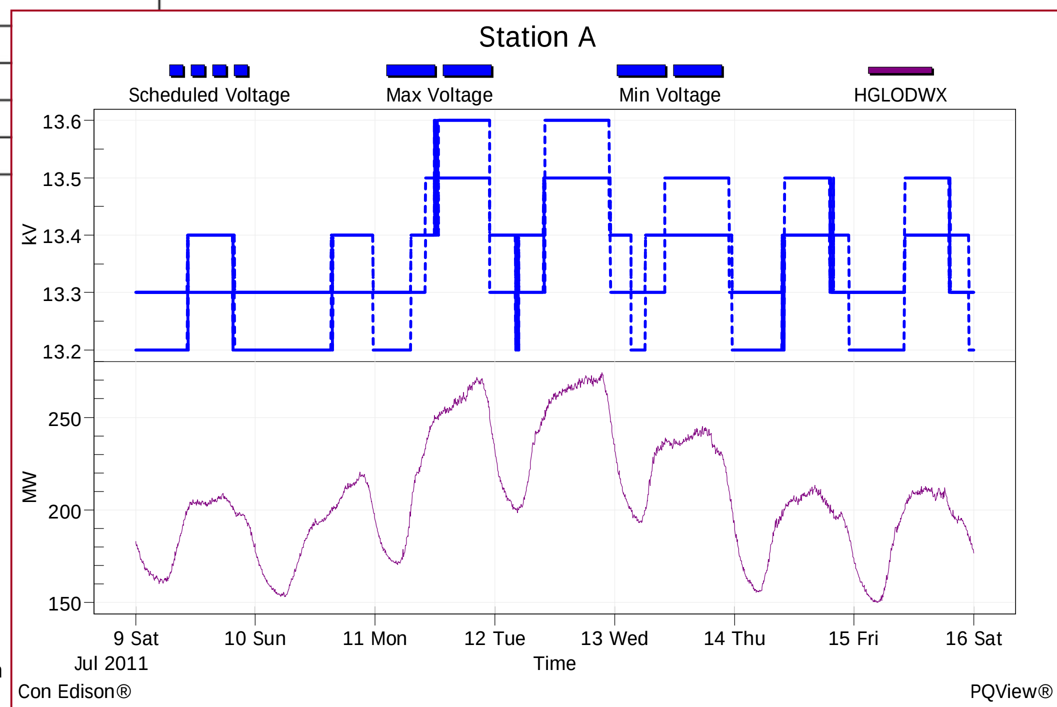
Methods of Controlling Area Substation Voltage

- Voltage Var Control (VVC)
- Local Tap Changer Control System
- Manual Adjustment of Transformer Taps

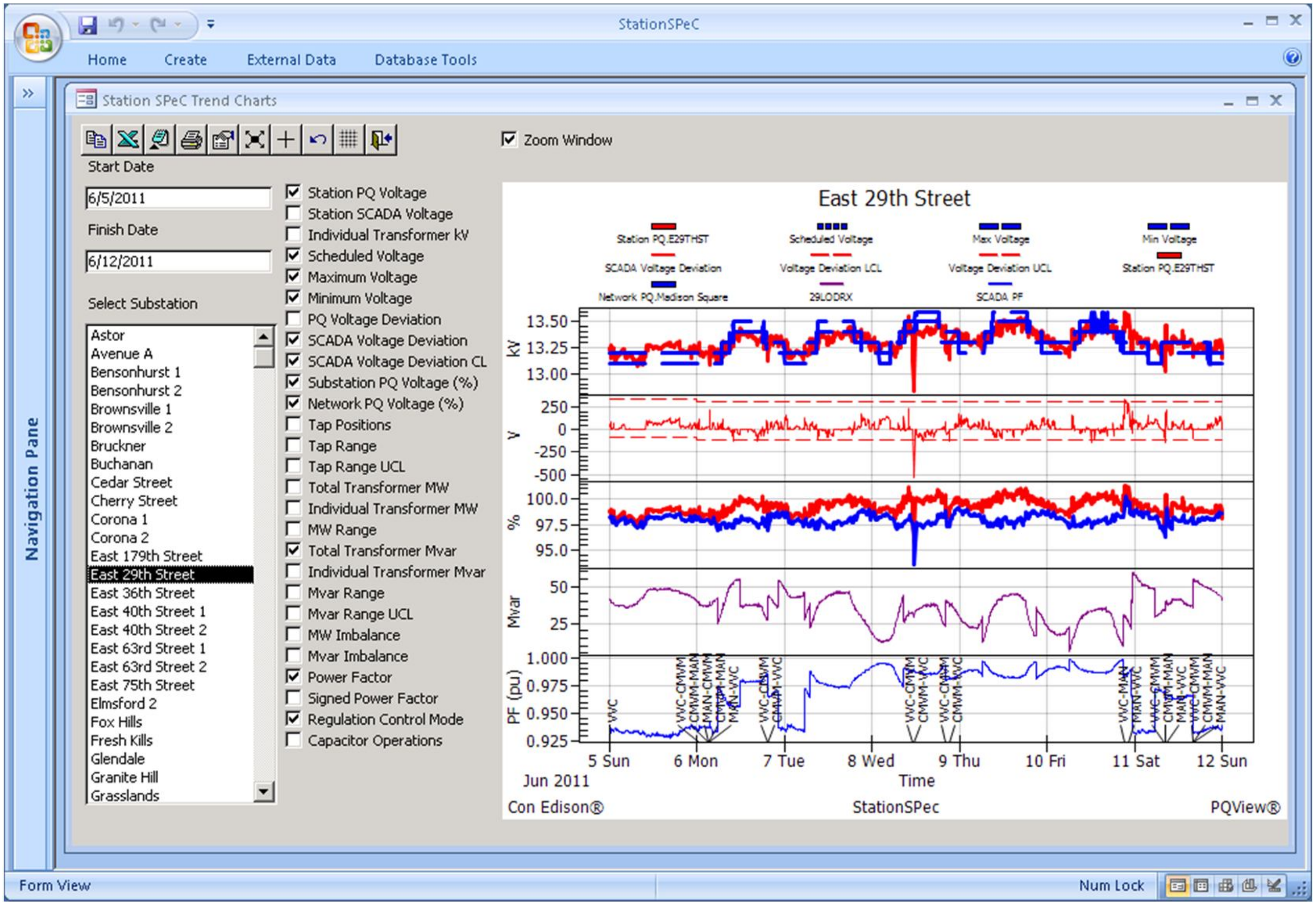
Area Substation Voltage Control

Area Substation Load versus Voltage Schedule

TOTAL 13KV BUS LOAD (Megawatts)	13KV Feeder Bus Volts
0 - 50	13,000
51 - 100	13,100
101 - 150	13,200
151 - 200	13,300
201 - 250	13,400
251 - 300	13,500
Above 300	13,600



Development of Data Federation Tool *StationSPeC*



StationSPeC Challenges

conEdison, inc.

- StationSPeC allows us to analyze data from different monitoring systems in different PQView databases with different sampling rates
  - DataNodes and PQNodes programmed to record a sample once every 10 minutes
  - PI saves SCADA analog values using a swinging door compression method
  - PI saves breaker operations as discrete events
- Not all values are stored directly in either PI or PQView. Some are derived at analysis time:
  - Which of the station's five transformers are in service at a given moment in time
  - The percentage of a week that a capacitor is in service
  - Tap positions are stored in compressed form in PI, but we need to quantize the positions through a decompression technique

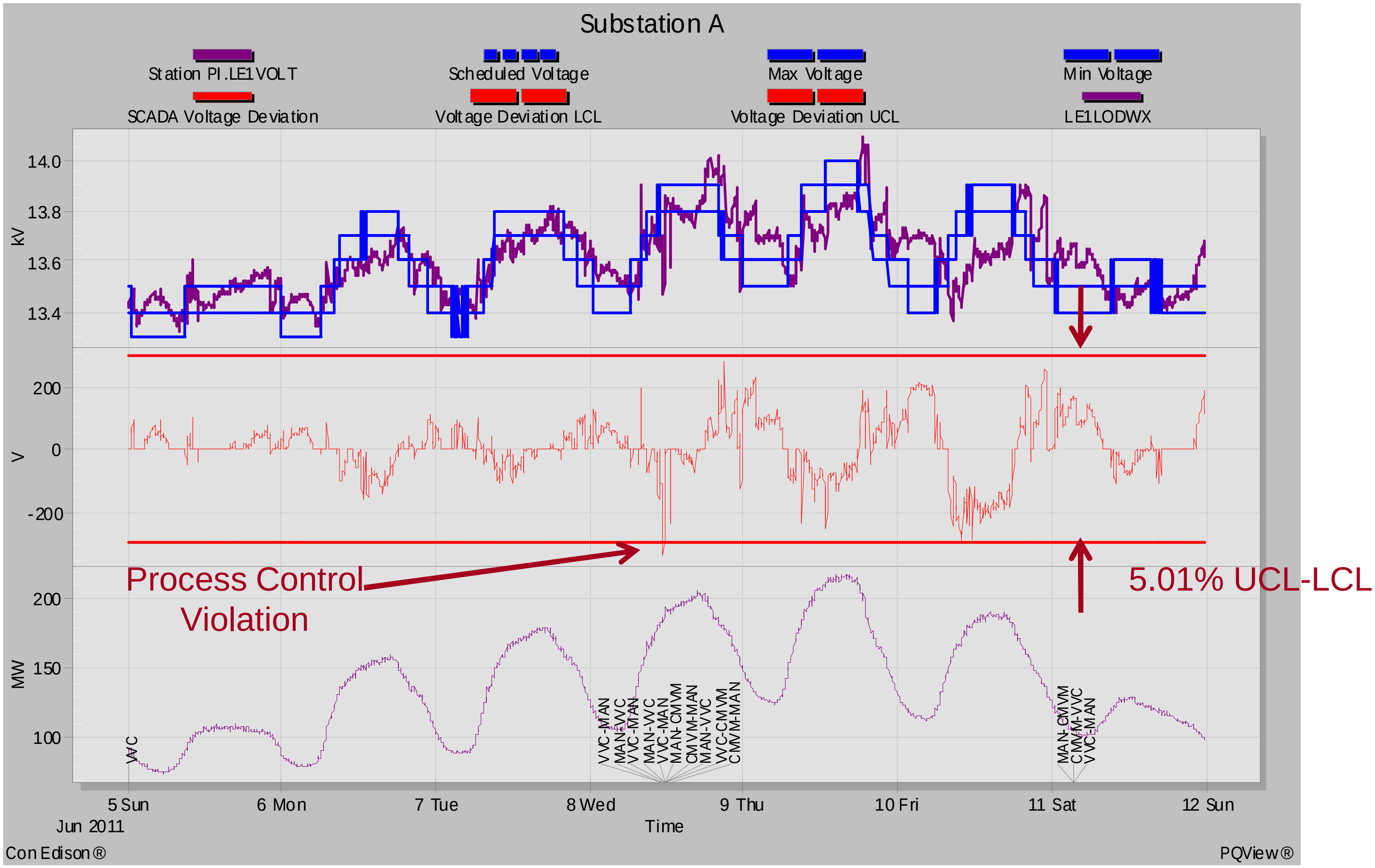
EPRI ELECTRIC POWER RESEARCH INSTITUTE

Area Substation Voltage Control

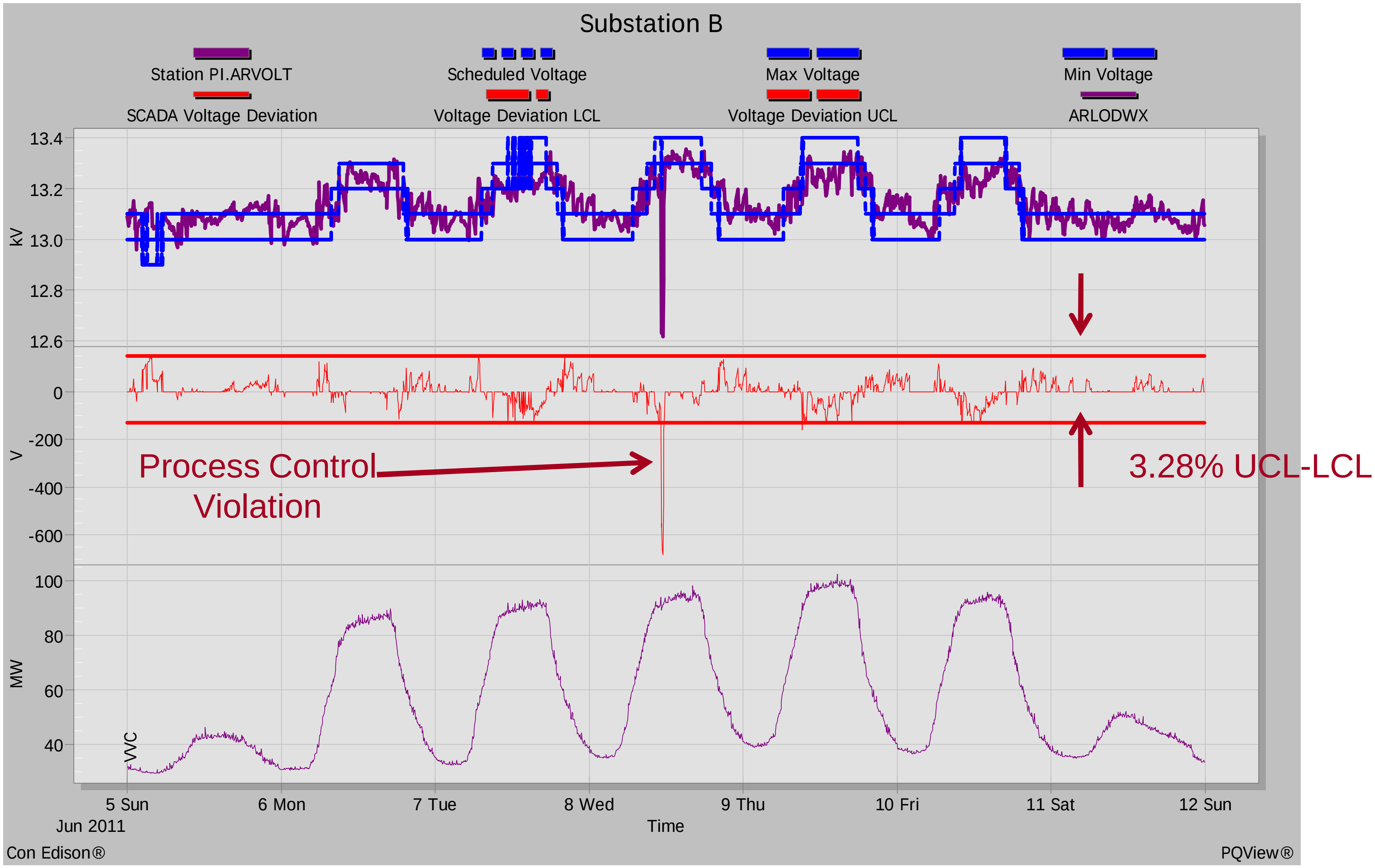
Voltage Control and Optimization

- Process Control Tool Development
  - Control Variables
    - Voltage Deviation from Schedule
    - Range of Tap positions on Parallel Transformers
    - Range of Mvar Load on Parallel Transformers
  - Apply control chart methods to develop upper and lower control limits

Development of Control Charts
Voltage Deviation

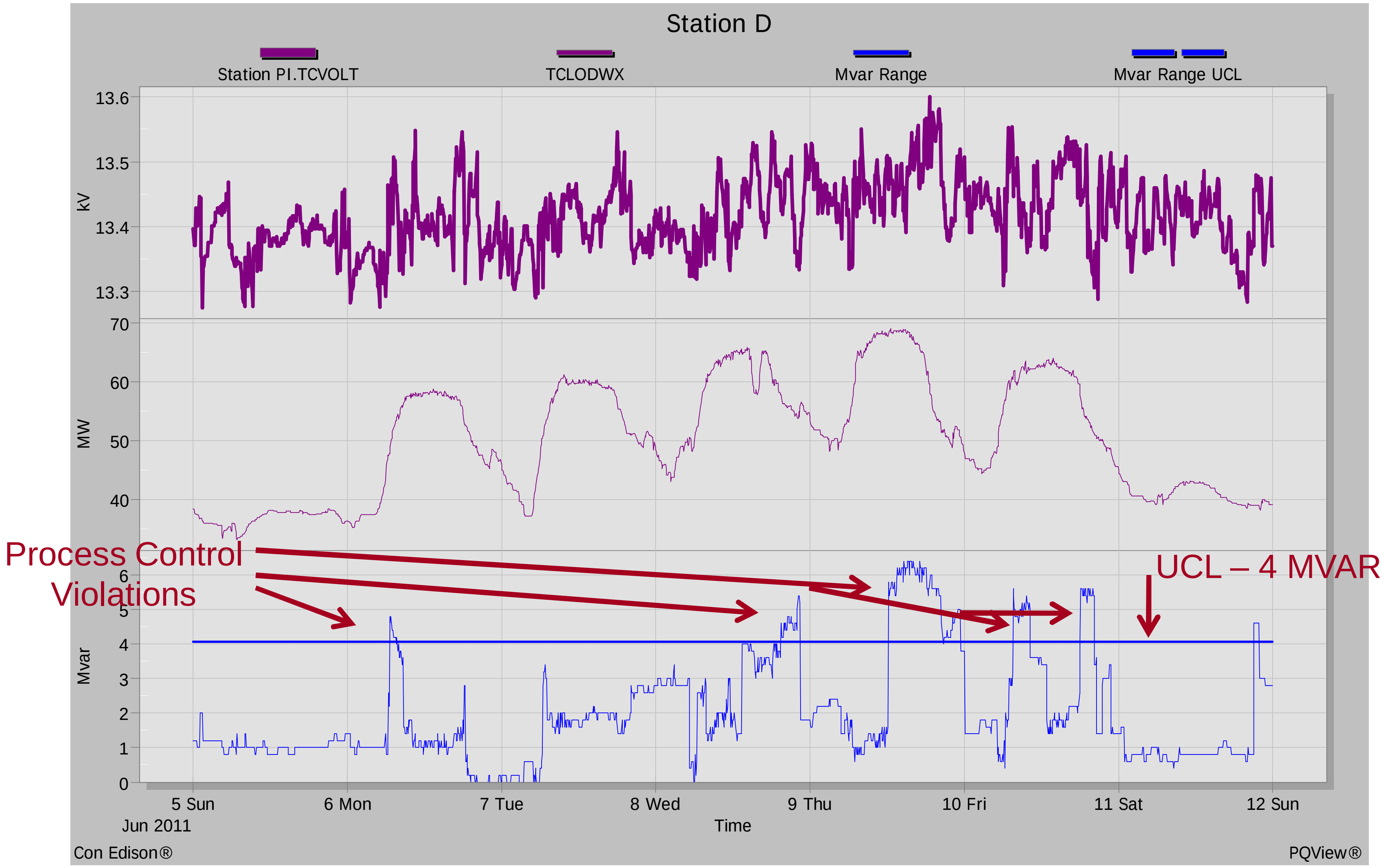


Development of Control Charts
Voltage Deviation



Development of Control Charts
Tap Position Spread

Development of Control Charts
Reactive Power Balance



Area Substation Weekly Report
Voltage Regulation Control

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StationSPeC

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Navigation Pane

Station	Week	Volt Dev SPC	Tap Range SPC	Mvar Range SPC	Avg Voltage Deviation	Zero Volt Deviation	Tap Range Avg	Tap Range Max	Mvar Range Avg	Mvar Range Max	PF Range Avg	PF Range Max	Reg Ctrl Mode VVC	Reg Ctrl Mode CMVM	Reg Ctrl Mode Man
East 29th Street	07/11/2011	Yes	Yes	Yes	27.35	48.31%	0.07	4.00	0.65	8.10	0.97	1.00	99.16%	0.25%	0.60%
East 36th Street	07/11/2011	Yes	Yes	Yes	20.07	52.78%	0.46	2.00	0.39	2.88	0.97	1.00	98.61%	0.00%	1.39%
East 40th Street 1	07/11/2011	Yes	Yes	Yes	29.68	48.71%	0.59	3.00	1.50	5.84	0.98	1.00	100.00%	0.00%	0.00%
East 40th Street 2	07/11/2011	Yes	Yes	Yes	27.34	56.65%	1.06	7.00	1.27	13.80	0.97	1.00	96.92%	2.98%	0.10%
East 63rd Street 1	07/11/2011	Yes	Yes	Yes	-0.79	58.58%	9.45	21.00	5.91	23.50	0.96	1.00	98.07%	0.55%	1.39%
East 63rd Street 2	07/11/2011	Yes	Yes	Yes	24.77	53.47%	8.02	17.00	6.02	16.90	0.98	1.00	90.87%	2.03%	7.09%
Hell Gate	07/11/2011	Yes	Yes	Yes	5.95	62.95%	2.50	13.00	4.46	11.86	1.00	1.00	81.55%	5.85%	12.60%
Murray Hill	07/11/2011	Yes	Yes	Yes	15.65	52.88%	1.16	3.00	0.94	3.20	0.95	1.00	100.00%	0.00%	0.00%
Parkview	07/11/2011	Yes	Yes	Yes	8.09	64.34%	0.00	0.00	0.24	1.00	0.97	0.99	100.00%	0.00%	0.00%
Plymouth Street	07/11/2011	Yes	Yes	Yes	26.80	58.33%	0.48	7.00	1.94	20.67	0.97	1.00	98.31%	0.79%	0.89%
Seaport 1	07/11/2011	Yes	Yes	Yes	13.74	58.43%	4.59	6.00	1.69	7.60	0.97	1.00	100.00%	0.00%	0.00%
Seaport 2	07/11/2011	Yes	Yes	Yes	26.12	49.45%	3.97	6.00	3.06	11.26	0.96	1.00	99.26%	0.74%	0.00%
Sherman Creek	07/11/2011	Yes	Yes	Yes	33.18	50.10%	3.83	15.00	13.92	30.72	0.99	1.00	0.00%	15.58%	84.42%
Trade Center 1	07/11/2011	Yes	Yes	Yes	11.02	57.89%	2.68	9.00	2.58	12.80	0.95	1.00	86.66%	13.14%	0.20%

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Each cell is interactive. When you double-click on a cell, you see the five-minute samples for that week in an interactive window.

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Area Substation Weekly Report
Power Factor Summary

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StationSPeC

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Navigation Pane

Station	Week	PF Min	PF Avg	PF Max	Weekday PF Min	Weekday PF Avg	Weekday PF Max	Weekend PF Min	Weekend PF Avg	Weekend PF Max	Leading PF Hours	Leading PF Avg	Service Hours Cap 1	Service Hours Cap 2	Service Hours Cap 3
East 29th Street	07/11/2011	83.63%	97.49%	99.94%	93.20%	97.89%	99.94%	83.63%	96.48%	99.17%	0.00%		74.26%	71.38%	37.55%
East 36th Street	07/11/2011	87.26%	96.65%	100.00%	87.26%	97.50%	100.00%	88.41%	94.59%	99.85%	1.39%	-99.82%	80.06%	57.24%	31.75%
East 40th Street 1	07/11/2011	89.74%	97.73%	100.00%	89.74%	97.62%	100.00%	0.00%	97.85%	100.00%	5.26%	-99.86%	31.85%	62.40%	94.59%
East 40th Street 2	07/11/2011	89.57%	96.90%	100.00%	89.87%	97.24%	100.00%	0.00%	95.99%	99.68%	40.28%	-99.58%	76.98%	62.75%	37.40%
East 63rd Street 1	07/11/2011	89.92%	96.44%	99.99%	89.92%	95.55%	99.80%	96.44%	98.66%	99.99%	0.00%		85.32%	75.15%	0.00%
East 63rd Street 2	07/11/2011	95.06%	98.09%	100.00%	95.06%	97.70%	100.00%	97.15%	99.16%	100.00%	5.85%	-99.98%	71.78%	0.00%	0.00%
Hell Gate	07/11/2011	98.00%	99.55%	100.00%	98.00%	99.51%	100.00%	98.25%	99.63%	100.00%	12.60%	-99.85%	88.84%	90.87%	82.94%
Murray Hill	07/11/2011	91.64%	94.84%	99.78%	91.73%	95.80%	99.78%	91.64%	92.44%	93.15%	0.00%		0.00%	0.00%	100.00%
Parkview	07/11/2011	93.48%	96.54%	99.46%	93.57%	96.97%	99.46%	93.48%	95.46%	99.06%	0.00%		100.00%	0.00%	0.00%
Plymouth Street	07/11/2011	93.15%	97.13%	100.00%	93.15%	97.20%	100.00%	93.49%	96.96%	99.75%	4.71%	-99.93%	55.36%	54.27%	38.64%
Seaport 1	07/11/2011	91.60%	97.21%	100.00%	91.60%	97.18%	100.00%	92.55%	97.28%	99.41%	1.84%	-99.97%	89.29%	100.00%	100.00%
Seaport 2	07/11/2011	89.19%	96.20%	100.00%	89.19%	95.51%	100.00%	90.20%	97.34%	99.98%	24.11%	-99.71%	45.44%	20.29%	64.73%
Sherman Creek	07/11/2011	95.49%	99.21%	100.00%	97.82%	99.58%	100.00%	95.49%	98.20%	100.00%	7.59%	-99.98%	86.71%	89.19%	85.86%
Trade Center 1	07/11/2011	91.90%	95.09%	100.00%	91.90%	95.31%	100.00%	92.27%	94.78%	99.01%	32.24%	-96.77%	100.00%	100.00%	79.37%

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Area Substation Weekly Report
Tap Changer Summary

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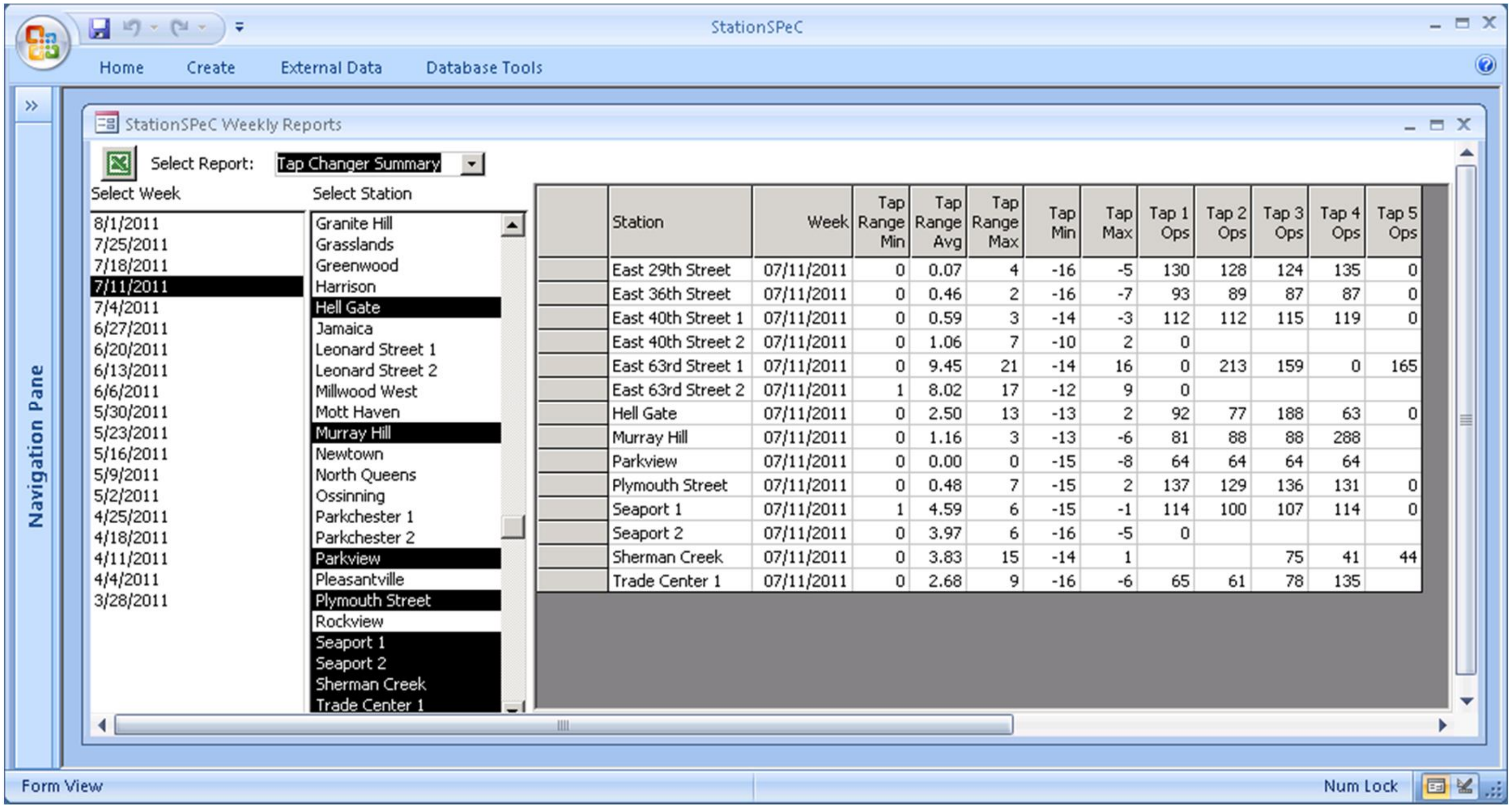

Station	Week	Tap Range Min	Tap Range Avg	Tap Range Max	Tap Min	Tap Max	Tap 1 Ops	Tap 2 Ops	Tap 3 Ops	Tap 4 Ops	Tap 5 Ops
East 29th Street	07/11/2011	0	0.07	4	-16	-5	130	128	124	135	0
East 36th Street	07/11/2011	0	0.46	2	-16	-7	93	89	87	87	0
East 40th Street 1	07/11/2011	0	0.59	3	-14	-3	112	112	115	119	0
East 40th Street 2	07/11/2011	0	1.06	7	-10	2	0				
East 63rd Street 1	07/11/2011	0	9.45	21	-14	16	0	213	159	0	165
East 63rd Street 2	07/11/2011	1	8.02	17	-12	9	0				
Hell Gate	07/11/2011	0	2.50	13	-13	2	92	77	188	63	0
Murray Hill	07/11/2011	0	1.16	3	-13	-6	81	88	88	288	
Parkview	07/11/2011	0	0.00	0	-15	-8	64	64	64	64	
Plymouth Street	07/11/2011	0	0.48	7	-15	2	137	129	136	131	0
Seaport 1	07/11/2011	1	4.59	6	-15	-1	114	100	107	114	0
Seaport 2	07/11/2011	0	3.97	6	-16	-5	0				
Sherman Creek	07/11/2011	0	3.83	15	-14	1			75	41	44
Trade Center 1	07/11/2011	0	2.68	9	-16	-6	65	61	78	135	

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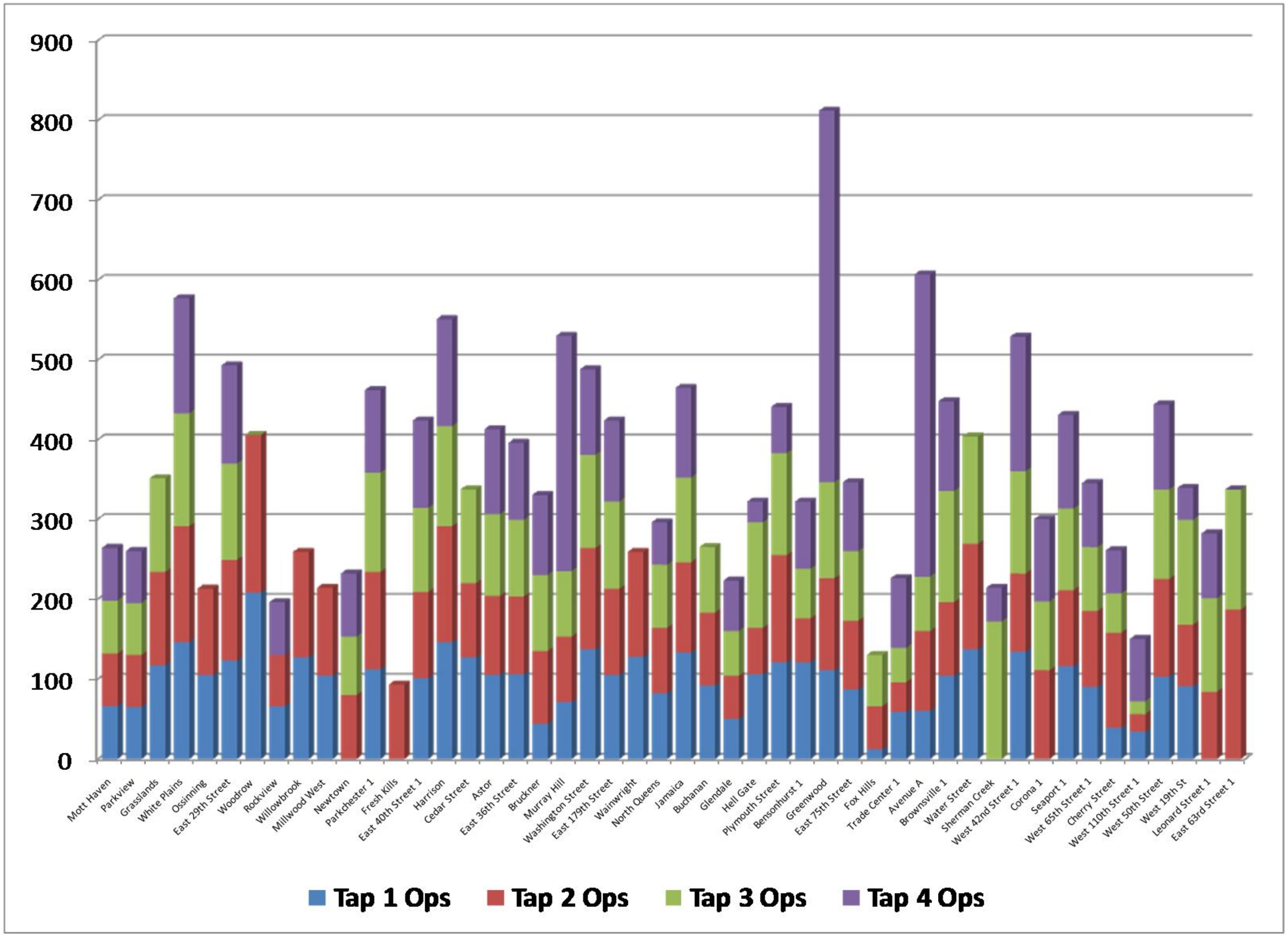
Area Substation Tap Changer Summary

- Tap Range among parallel transformers

- Tap Operations on parallel transformers



Summary

Federation of PQ Monitors with a SCADA Historian for Regulation Assessment

- Tool for Regulation Assessment
- Integrates several data sources and analysis tools
  - IEDs & SCADA & Historian
  - Scalable
  - Expandable
- Tool Provides:
  - Automation of Statistical Process Control Techniques
    - Identifies when regulation process is “out of control”
  - Potential for more precise voltage optimization for real and reactive power conservation
  - More precise information for advancement of asset management techniques

Conclusion

- Electric Utilities can save money if they use the data effectively.
  - Reduce customer complaints and payments
  - Review the data to identify problems with equipment and take proactive action before failures occur.
  - Manage Voltage more efficiently by improving voltage control.
  - Improve the operation of assets by monitoring parameters like power factor, tap setting spreads and tap operations.