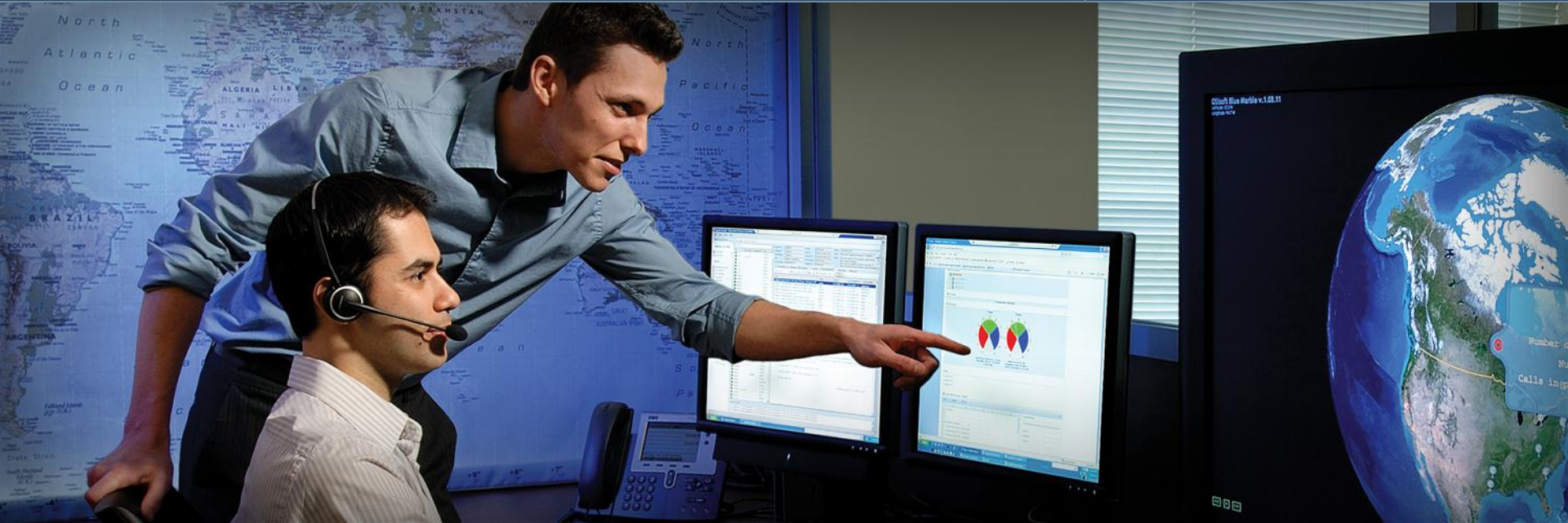




# Regional Seminar Boston



## Condition-Based Maintenance (CBM) - PSE&G Case Study

Keith Pierce  
Center of Excellence (CoE) Engineer  
OSIsoft

November 2010

Empowering Business in Real Time.

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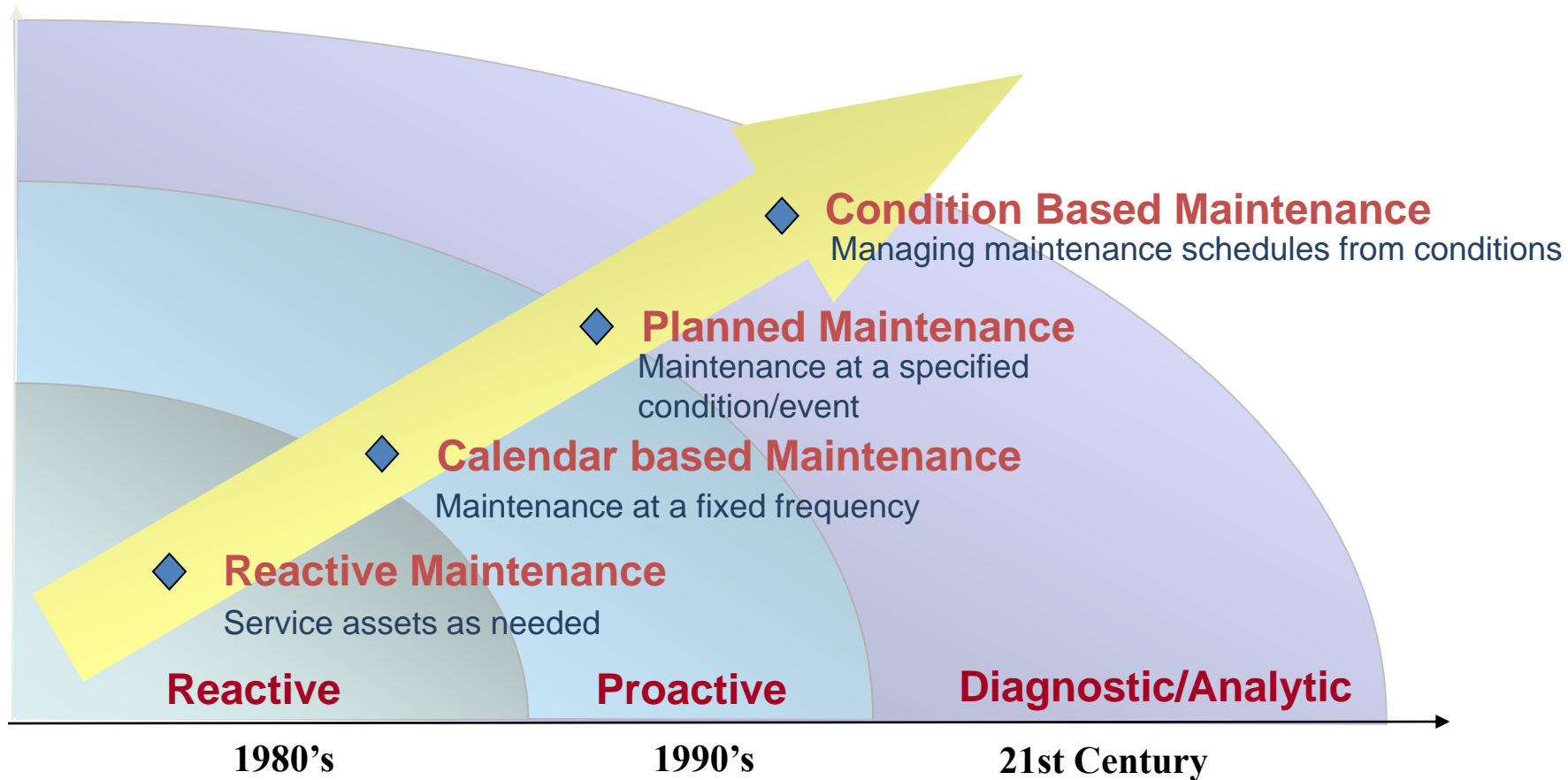
- CBM Background
- PSE&G Overview
- Motivating Factors & Background
- System Overview
- Condition Assessment
- Benefits
- Q&A

# Condition-Based Maintenance

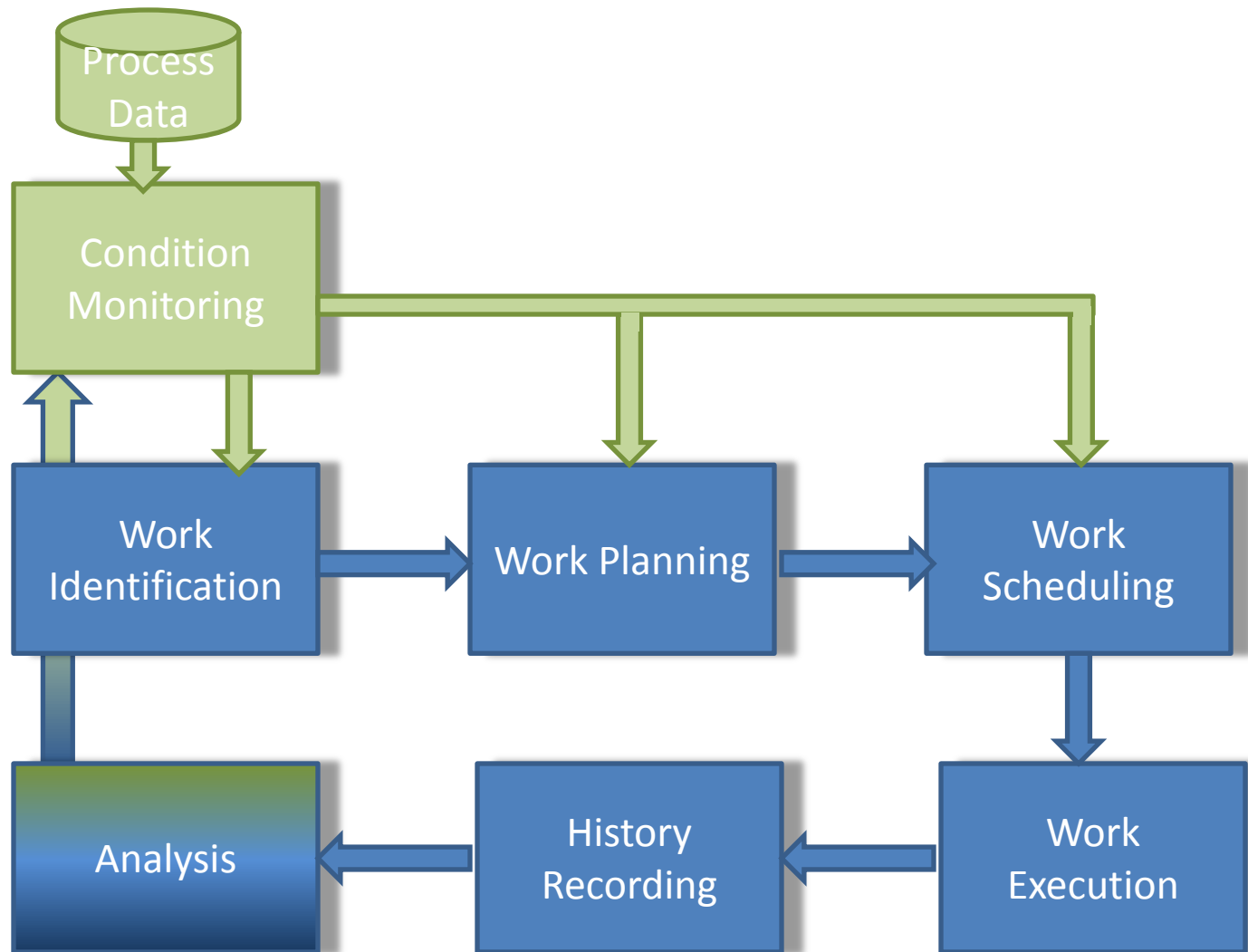


## Definitions

# Maintenance Evolution - Reliability



- Predictive Maintenance (PdM)- using a parameter to determine when an asset may fail
- Condition Monitoring (CM) - using a parameter or information about an asset to determine its condition (in regard to that specific parameter)
- Condition-Based Maintenance (CBM)- determining maintenance schedules based on condition type indicators
- Model-Driven Monitoring - based on optimal model for current conditions.
- Reliability Centered Maintenance (RCM) -includes processes to ensure assets perform as required - may involve all of the above plus ancillary functions (training, parts, etc.)



- Maintenance Plan Fundamentals

- Quantitative



- Qualitative



- Requirements

- Indicative Data

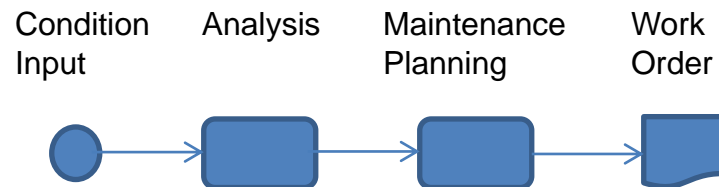
- Integration with Work Management

- Implementation Lifecycle

- It's a journey - very easy to start small

- Motivate Key Personnel

- Change Management



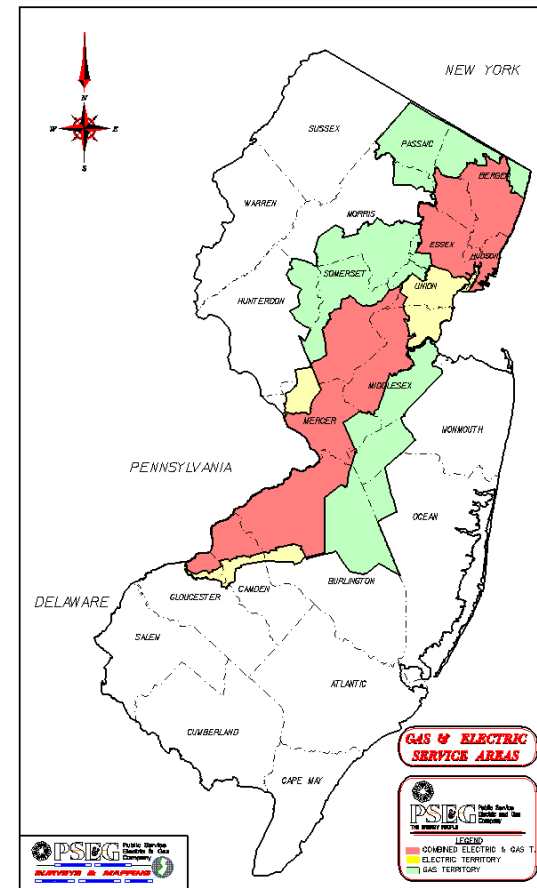
## PSE&G Customer Case Study

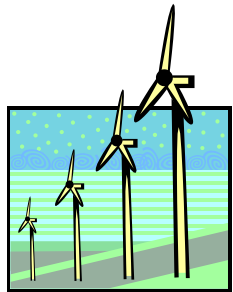


## Condition-Based Maintenance at an Electric Utility

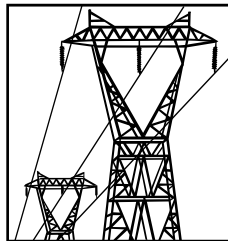


- Utility Overview
  - New Jersey Based
  - Total Assets ~ \$14 Billion
  - Total Revenue ~ \$7 Billion
- Service Territory
  - 70% of New Jersey's population
  - 2.0 million Electric customers
  - 1.6 million Gas customers
  - 2,600 Square Miles
- Delivery Implementation
  - 1999 - SAP
  - 2000 - OMS, GIS & CAD
  - 2002 - CMMS

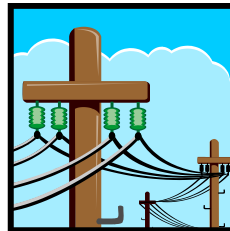




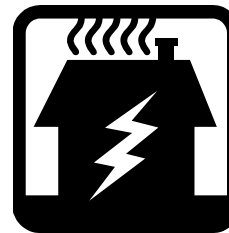
Generation



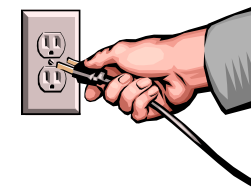
Transmission



Distribution



Household



Outlet

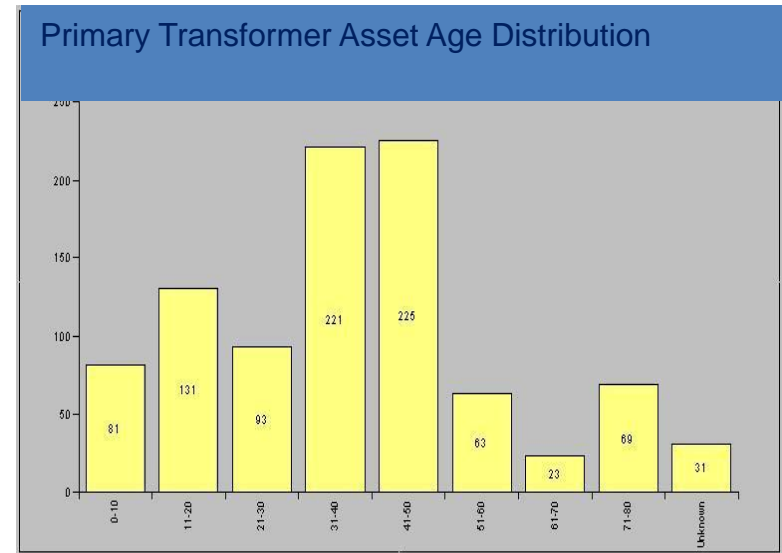
- Focused on the electrical transmission and distribution (T&D) arm of the Delivery Organization
- Primary assets are large transformers and breakers

## PSE&G Customer Case Study

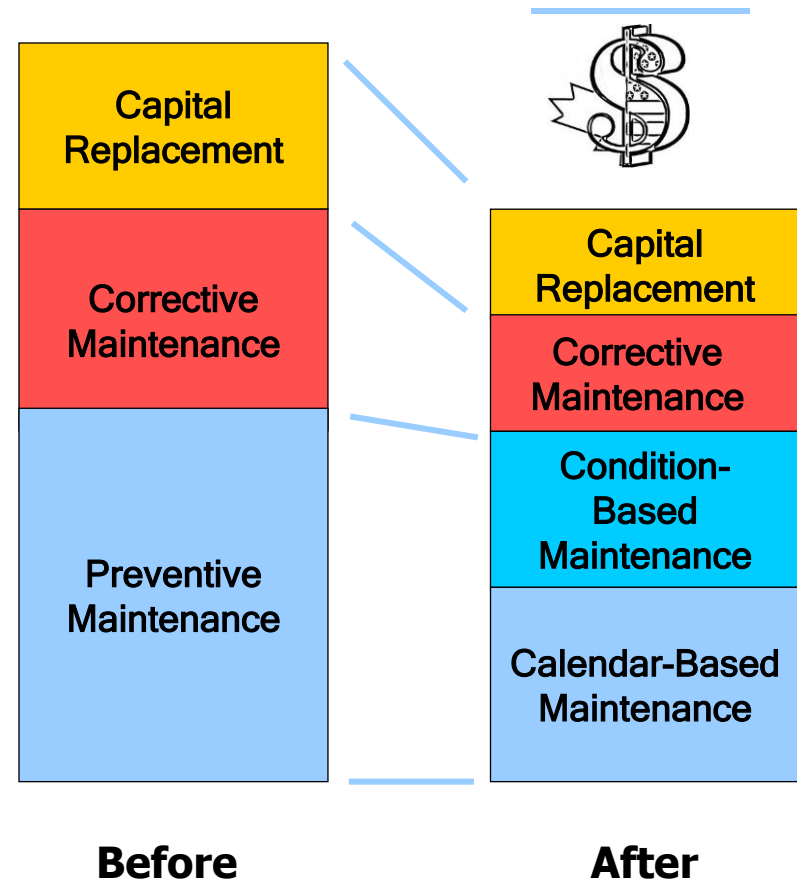


### Business Challenge / Problems Addressed

- Significant risk of system outage potential from old equipment vulnerable to failure
- No formal capital expenditure determination plan
- No formal preventive maintenance scheduling program
- Expensive Replacement Projects
- Loss of Expertise
- After an equipment failure, sufficient data collected to determine why - Asset Information in a variety of disparate systems
- Lots of features & functions in SAP PM
- Upgrades & Enhancements in Work Management, Outage Management, Distribution Operations, etc.



- Reduce risks of business interruption
  - Fewer outages
  - Fewer induced errors
  - More focused work effort
- Condition-based maintenance (CBM)
  - Less PM, Less CM
  - More targeted Capital Expenditures
- Work prioritization
  - Focus on the assets in the most need and the most critical
- Capital replacement strategies
  - Target worst performing assets
- Data/information organization and visualization
  - Faster issue resolution
  - Root cause failure analysis
- Platform to support decision support solutions based on the assets and available data
  - Circuit analysis
  - Grid conservation



- Determination of health indicator to focus asset management activities
  - Determine condition health indicators - use existing information
  - Normalize indicator across asset type and family
- Provide an analysis platform for engineering activities
  - Integrate data from various disparate systems
  - Simple, consistent tools for analysis
- Perform condition-based maintenance
  - Visualize condition health
  - Integrate with SAP PM
- ROI in < 3 years

- Asset Scope - T&D Substation
  - Transformers
  - Breakers
  - Related Equipment (Compressors, LTC, etc.)
- Work Process Scope
  - Substation Inspections
  - Diagnostic Data Collection
  - Preventive Maintenance Prioritization
  - Asset Health Review
  - Capital Replacement Determination

- System Interfaces
  - SAP PM historical data
  - SAP PM measurement documents (RLINK)
  - Transmission SCADA (PI-to-PI)
  - Distribution SCADA (ETL & PI BatchFile)
  - MV-90 Load Monitoring (ETL & PI BatchFile)
  - Lab Systems - DeltaX & Doble (ETL & PI BatchFile)
- Condition Assessment
  - Equation Builder
  - Diagnostic Displays

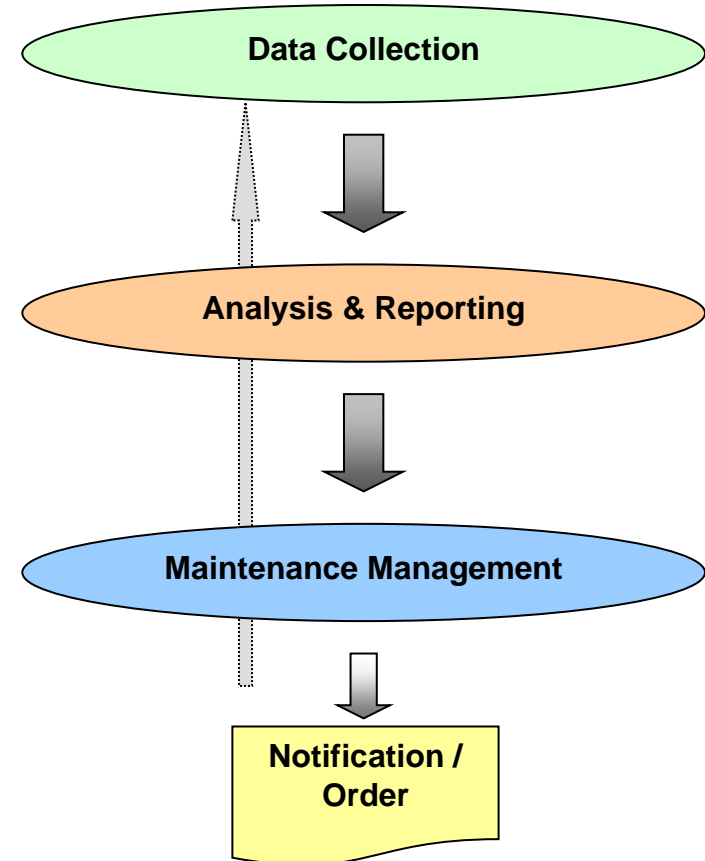


# Condition-Based Maintenance

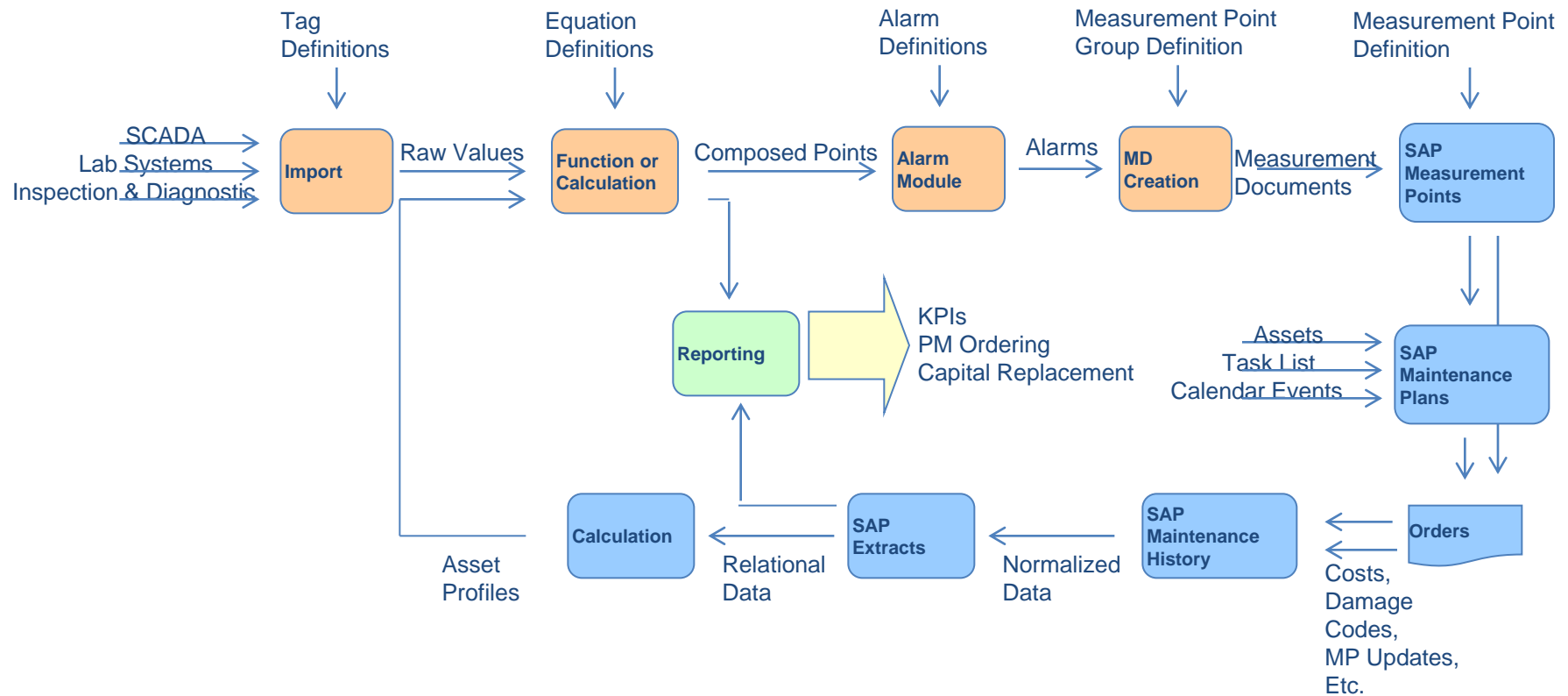


## System Overview

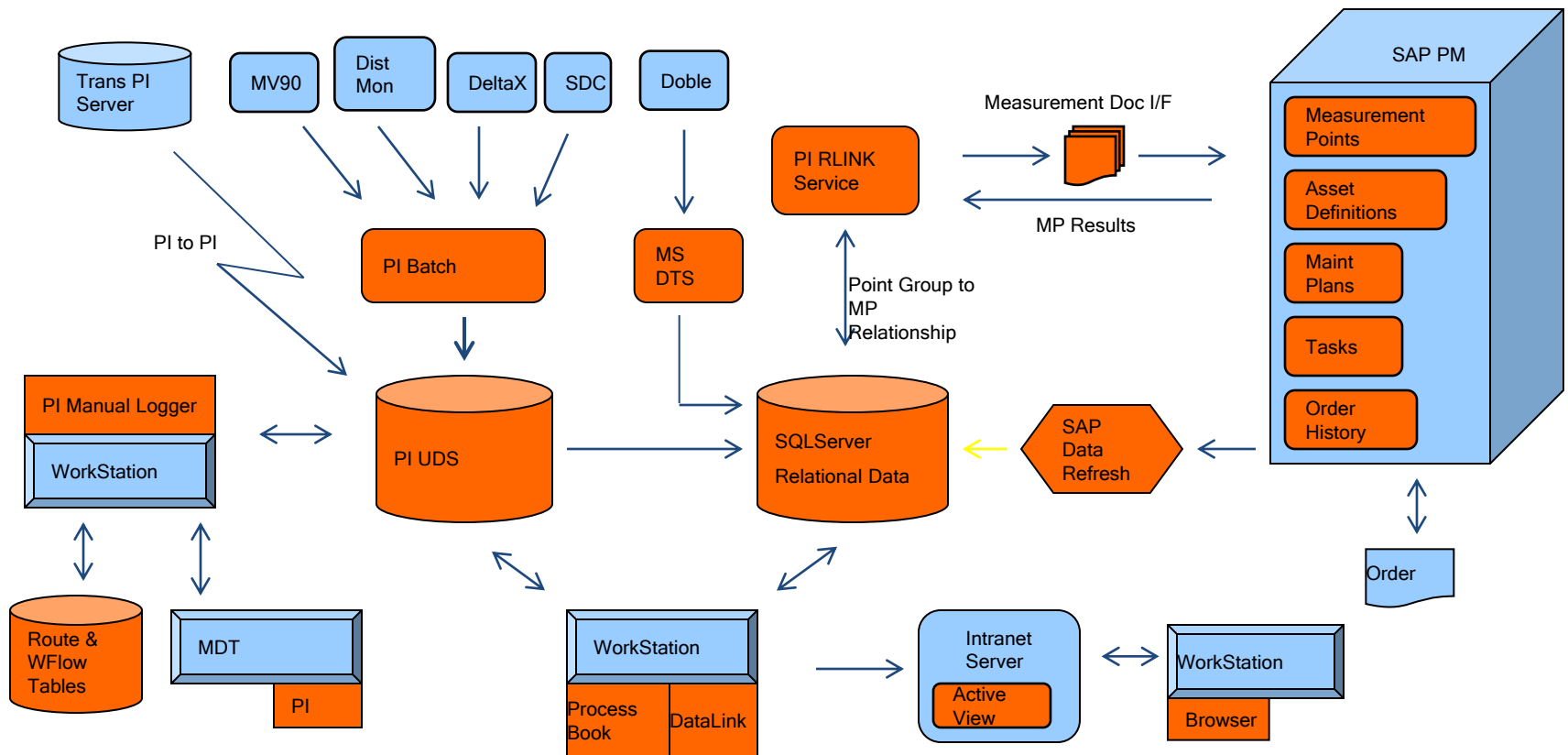
- **Data Collection**
  - SAP Asset Information
  - Time-Series Data Collection Application
  - Diagnostic and Inspection Data
- **Asset Analysis and Reporting**
  - Condition Assessment
  - Work Prioritization
  - Alerts / Notifications
- **Maintenance Management**
  - Measurement Points
  - Maintenance Plan Modifications
  - Notifications

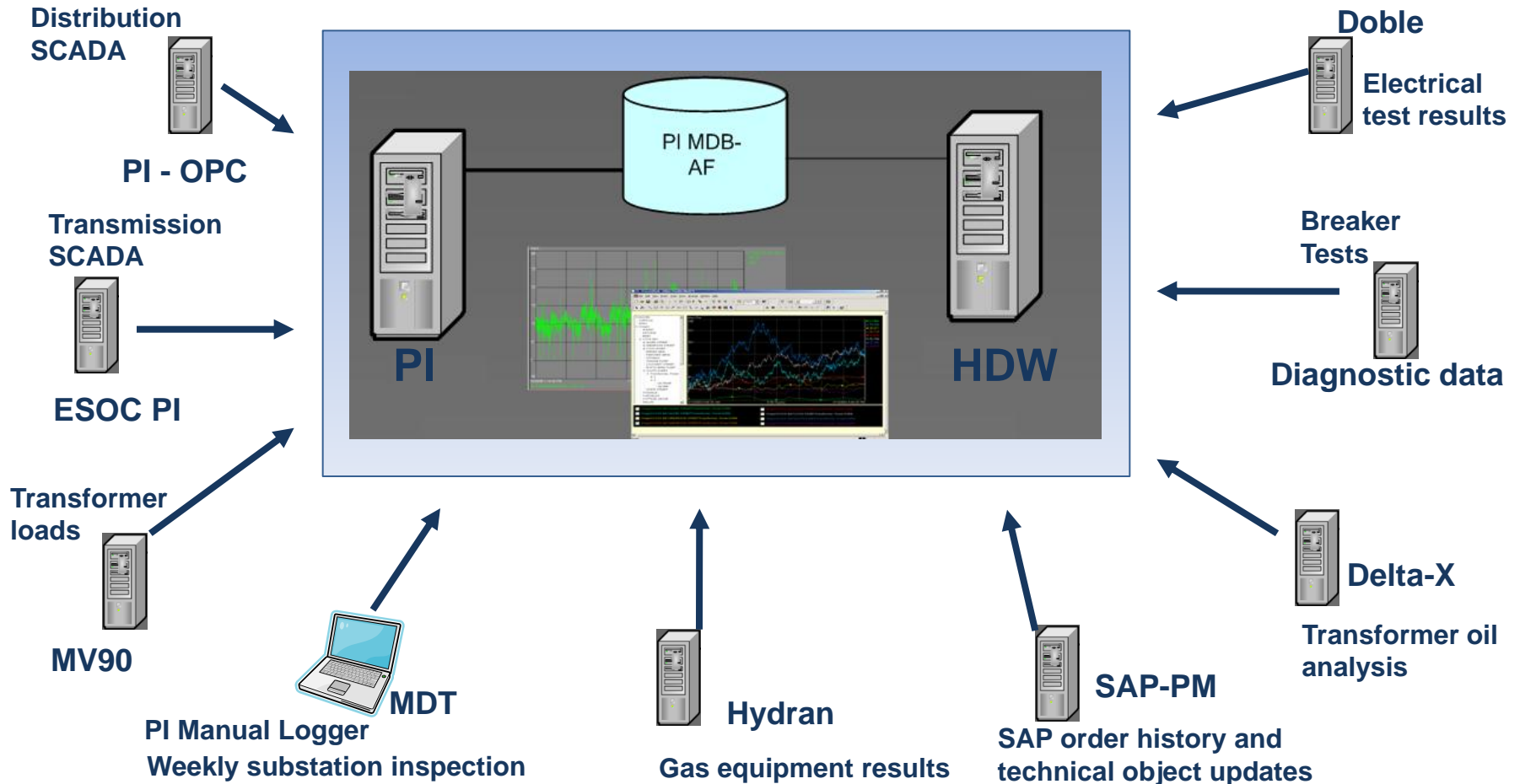


# System Model

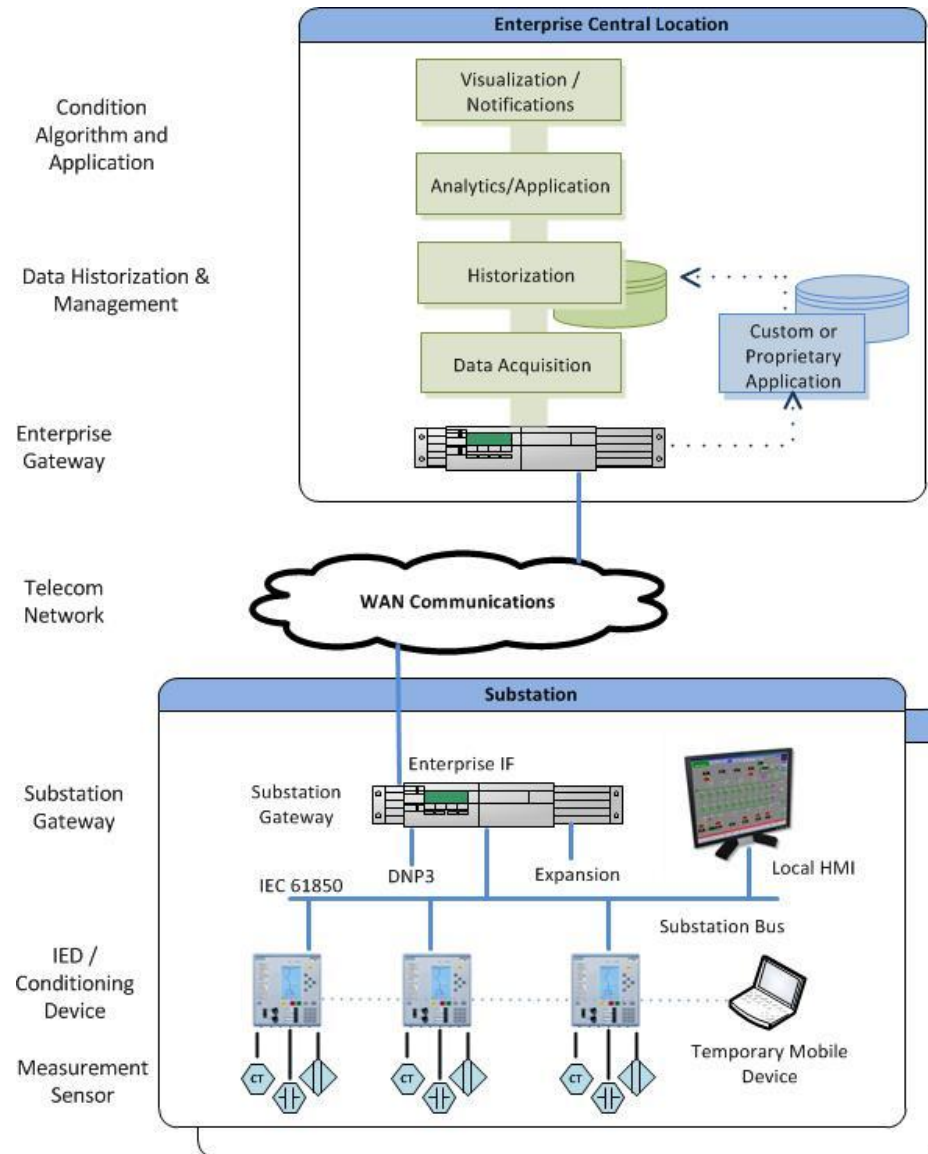


# Conceptual Design

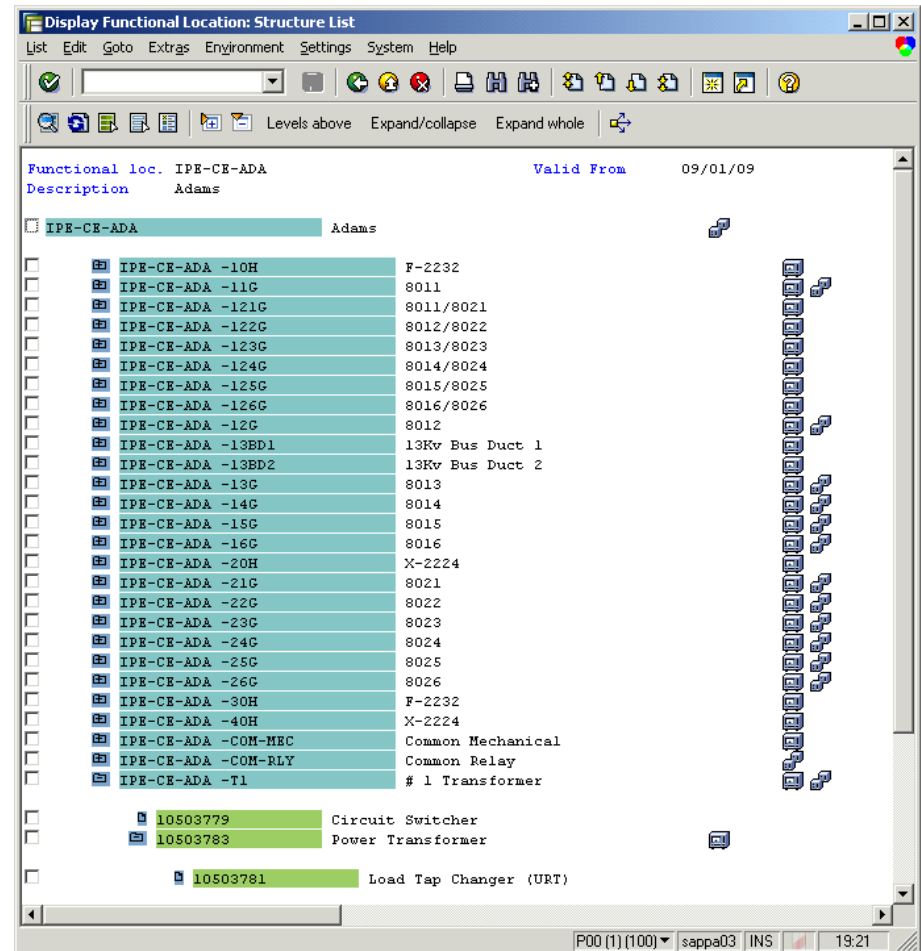




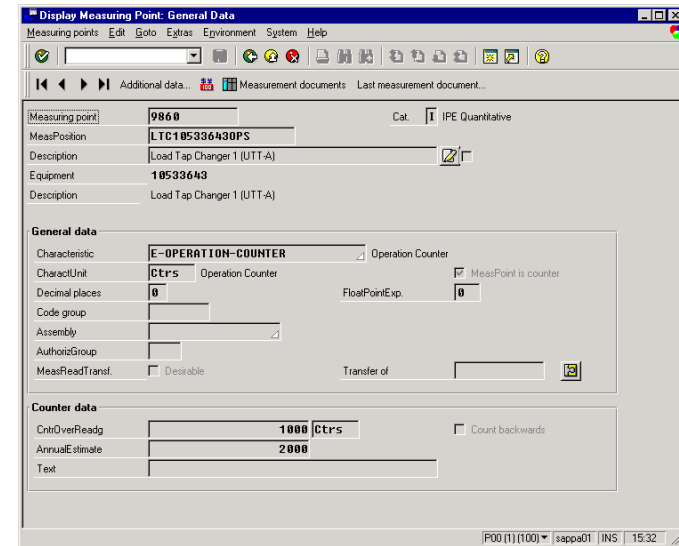
# More Modern Substation



- Equipment & Locations
  - Class and Characteristics
  - Nameplate
- Maintenance Plans (56k Plans)
  - Calendar-based
  - Counter-based
  - Condition-based
- Notifications
  - Damage and Cause Codes grouped by Equipment
- Equipment Visibility
  - PM Plan Cost/Hours vs. Actual
  - CM Cost



- Measurement Point Types
  - Qualitative (“Real Hot”)
  - Quantitative (> 220°F)
- Measurement Document
  - Absolute vs. Differential
  - Notification Generation
- Functional Uses
  - Counter Readings
  - LTC Movements
  - Runtime Hours
  - Breaker not operating
  - LTC not crossing neutral
  - Rate of Change



**Display Measuring Point: General Data**

Measuring points | Edit | Goto | Extras | Environment | System | Help

Measuring point: 9860 Cat: IPE Quantitative

MeasPosition: LTC105336430PS

Description: Load Tap Changer 1 (UTT-A)

Equipment: 10533643

Description: Load Tap Changer 1 (UTT-A)

**General data**

Characteristic: E-OPERATION-COUNTER Operation Counter

CharactUnit: Ctrs Operation Counter

Decimal places: 0 FloatPointExp: 0

Code group:

Assembly:

AuthorizGroup:

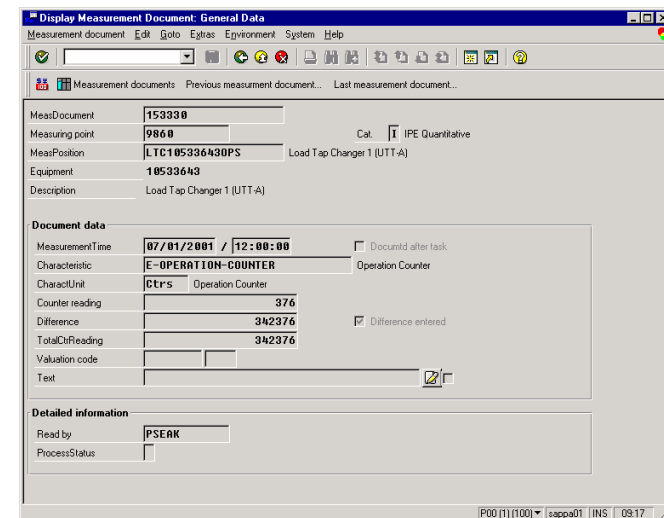
MeasHeadTransf: Desirable Transfer of:

**Counter data**

CntOverReadg: 1000 Ctrs Count backwards

AnnualEstimate: 2000

Text:



**Display Measurement Document: General Data**

Measurement document | Edit | Goto | Extras | Environment | System | Help

MeasDocument: 153330

Measuring point: 9860 Cat: IPE Quantitative

MeasPosition: LTC105336430PS Load Tap Changer 1 (UTT-A)

Equipment: 10533643

Description: Load Tap Changer 1 (UTT-A)

**Document data**

MeasurementTime: 07/01/2001 / 12:00:00 Documented after task

Characteristic: E-OPERATION-COUNTER Operation Counter

CharactUnit: Ctrs Operation Counter

Counter reading: 376

Difference: 342376 Difference entered

TotalCntReading: 342376

Valuation code:

Text:

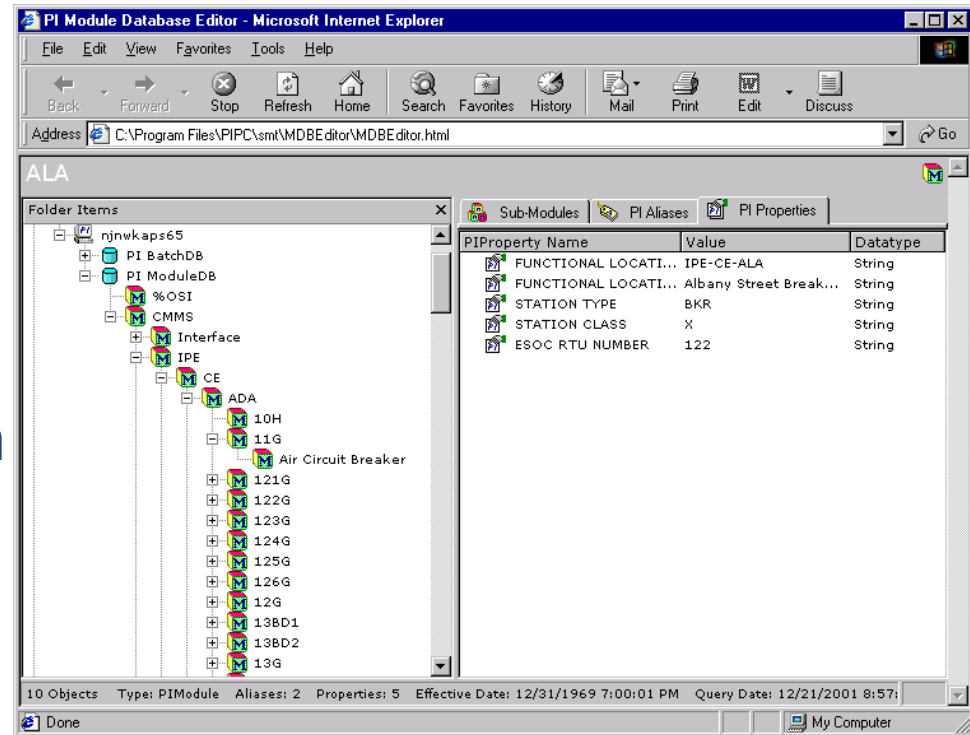
**Detailed information**

Read by: PSEAK

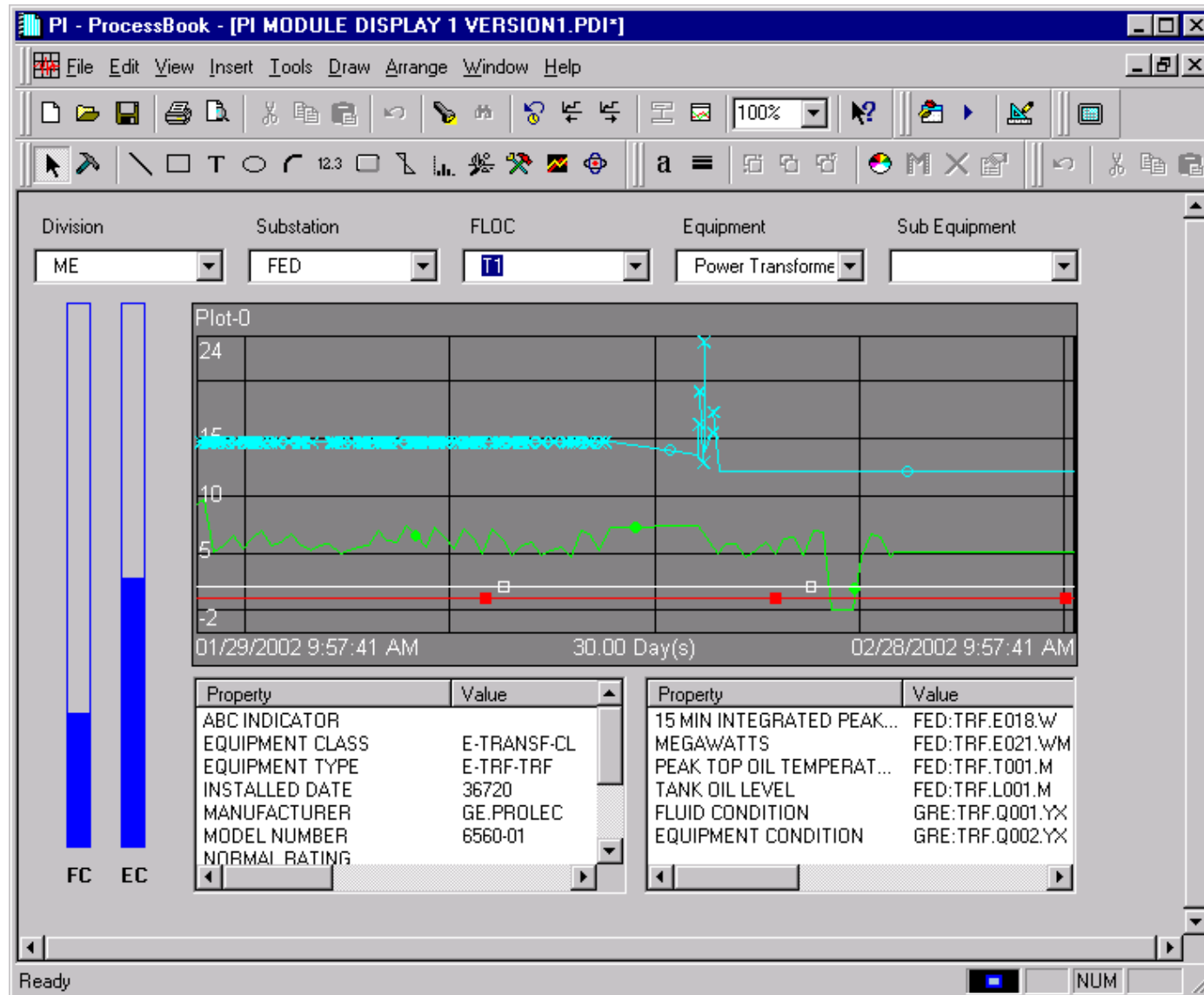
ProcessStatus:



- Define Module Taxonomy
  - Define Hierarchies
  - Each level has a parent-child relationship
  - Any module can appear many times in the hierarchy
  - Load the hierarchies
  - Provides context to displays and data

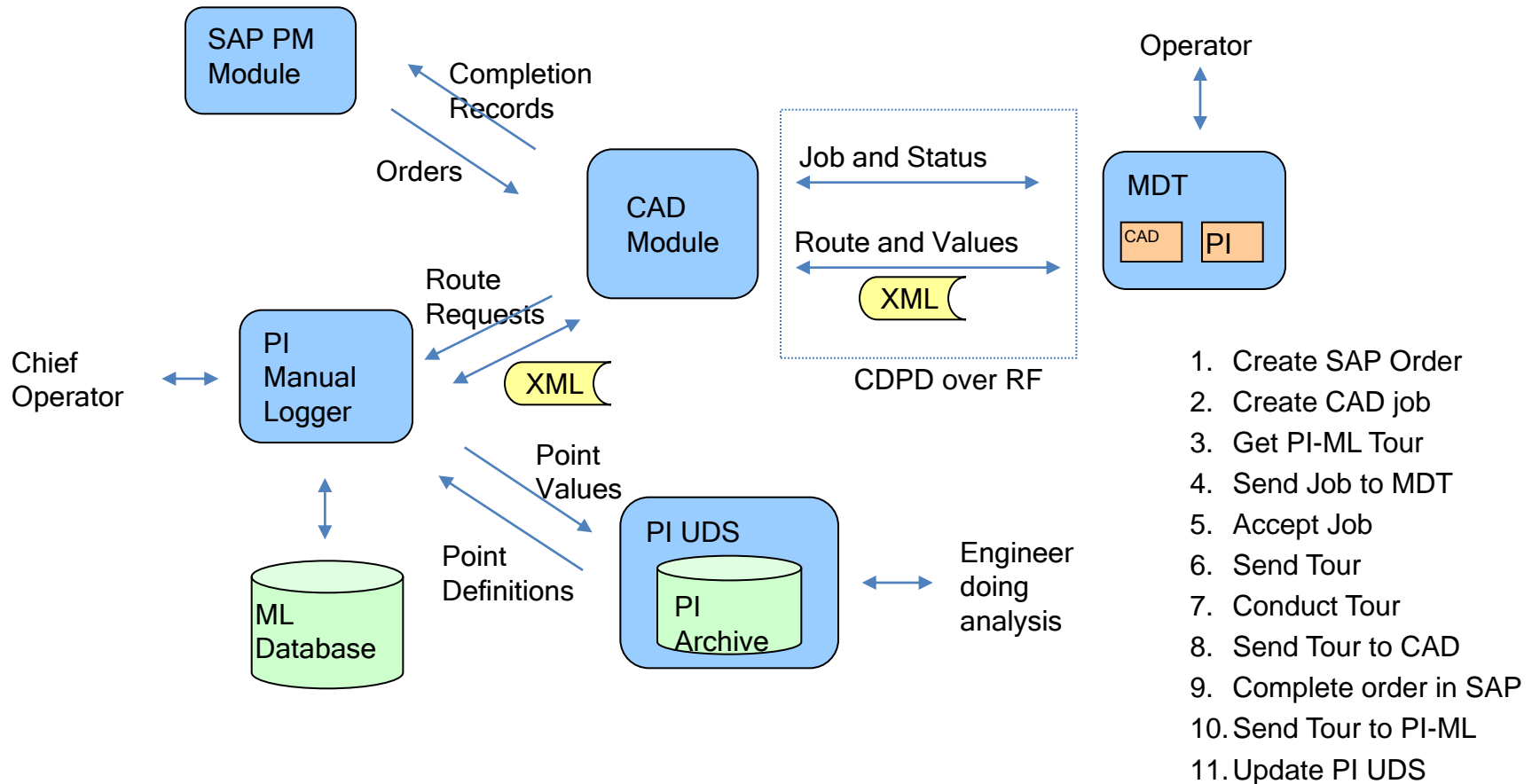


# PI MDB Enabled Displays



- Substation Inspections
- 300 Substations - Weekly and Peak Inspections
- 20 - 500 points per station
- Scheduled in SAP PM
- Dispatched using CAD Dispatch over RF and CDPD
- XML file transfers of tour definition and data
- Equipment Oriented Point Collection

# Inspection Design Overview



# PSE&G Customer Case Study



## Condition Assessment Overview

- Equations
  - $CA = F_1(M_1) + F_2(M_2) + F_3(M_3) + \dots$
- Example factor types include:
  - Average Load over time period
  - Last oil test results (SQL Query)
  - Maintenance cost data
  - Number of operations
- Factor components dependent on peer group
  - Apply calculations by peer group
  - Voltage, Class, Type
  - Example Groups:
    - 26KV - 69KV GCB
    - 138KV+ Power Transformer
    - LTC Vacuum Tanks

- Use of PI Module DataBase (MDB/AF)
  - Module for each level of the SAP PM hierarchy and installed functional locations and equipment
  - Defined peer groups and installed equipment modules
  - Defined factor types and equation groups
  - Created Module for each equation and for each equation factor
  - Developed displays using PI Module Database

# Factor Example



- Average MVA (load) factor
  - Type: PI Calc
  - Alias: Load in MVA
  - Start Time = \*
  - End Time = \*-30d
  - Mode: Average
  - Case: Assign value to factor
  - Multiplier = 0.2

The screenshot shows the 'PI Module Database Editor' window. The left pane displays a tree view of the database structure, with 'Average MVA' selected under 'Condition Assessment'. The right pane shows the 'PI Properties' for 'Average MVA'.

PIProperty Name	Value	Datatype
PI Alias	LOAD IN MVA	String
Start Time	*	String
End Time	*-30d	String
Mode	average	String
Type	PI Calc	String
Case		String
<10	10,0	String
<50	50,2	String
<200	200,5	String
<500	500,7	String
Else	Else,10	String
Multiplier	0.2	String

Error: -2147220447 - frmPIPropertyEdit - btnApply\_Click:addNew  
pisdcommon.dll : Cannot add duplicate name to the collection: Case



PI Module Database Editor - Microsoft Internet Explorer

File Edit View Favorites Tools Help

0-25KV

Folder Items

- PEER GROUPS
  - BKR TEST
  - Breakers
  - Circuit Switchers
  - Ltcs
  - Relays
  - Transformers
    - 0-25KV
    - 138-229KV
    - 230-344KV
    - 26-68KV
    - 345KV+
    - 69-137KV
  - TRF TEST
  - RLink
  - SUBSTATIONS
  - SUBSTATIONS

Sub-Modules PI Aliases PI Properties

Module Name

0000000000010017203	Voltage Regulator
0000000000010017215	Voltage Regulator
0000000000010017216	Voltage Regulator
0000000000010017217	Voltage Regulator
0000000000010017218	Voltage Regulator
0000000000010017219	Voltage Regulator
0000000000010017220	Voltage Regulator
0000000000010018487	Spare Voltage Regulator 13Kv (33-44 MVA)
0000000000010021749	Voltage Regulator 1
0000000000010021750	Voltage Regulator 2
0000000000010021751	Voltage Regulator 3
0000000000010021917	Voltage Regulator 1
0000000000010021918	Voltage Regulator 2
0000000000010023223	Voltage Regulator
0000000000010023224	Voltage Regulator

31 Objects Type: PIModule Aliases: 0 Properties: 0 Effective Date: 12/31/1969 7:00:01 PM Query Date: 8/4/2005 2:15:35 PM

Done My Computer

# Calculation Models in PI

PI Module Database Editor - Microsoft Internet Explorer

File Edit View Favorites Tools Help

## CM Costs

Folder Items

- My Module Databases
  - njnwks65
    - PI BatchDB
    - PI ModuleDB
      - %OSI
      - CMMS
        - ALGORITHMS
          - CA BREAKER
          - CA BREAKER - REPLACEMENT
            - ATB 26-765KV
              - CM Costs
              - CM Count
              - Compressor Motor Run Time
              - Compressor Oil Addition Frequency
              - Compressor Oil Addition Quantity
              - Ductor
              - Gas Addition Quantity
              - Incorrect Operations
              - Megger
              - Timing

Sub-Modules PI Aliases PI Properties

PIProperty Name	Value	Datatype
Multiplier	0.15	Double
Select	sum(actual_cost)	String
From	hdw_order	String
Where	equip_num={&EQ N...	String
Case		String
Type	DB SQL Query	String
Database	cmms	String
Server	njnwksql12	String

0 Objects Type: PIModule Aliases: 0 Properties: 8 Effective Date: 12/31/1969 7:00:01 PM Query Date: 8/4/2005 1:59:49 PM Creator: pia

Done My Computer

**Equipment Condition Assessment Module**

File View Records Help

! [Icons] ?

**Peer Group** Model 9

**Algorithm** CA LTC MODEL 1

	Score	FLOC	EQ Name	Description	Serial Num
	8.41	IPE-PA-NEW-T30	000000000010542736 Load Tap	Model 9/000000000010542	A0296T
	8.41	IPE-SO-CAS-UNIT 1	000000000010520986 Load Tap	Model 9/000000000010520	A117IX
	8.41	IPE-SO-SNF-4TRX	000000000010523972 Load Tap	Model 9/000000000010523	ALM22911
	7.51	IPE-PA-MAY-T2	000000000010542731 Load Tap	Model 9/000000000010542	6311166
	7.21	IPE-PA-MAY-T1	000000000010542730 Load Tap	Model 9/000000000010542	6311169
	7	IPE-SO-CAS-UNIT 2	000000000010520987 Load Tap	Model 9/000000000010520	A1181X
	6.7	IPE-PA-WAD-T20	000000000010542776 Load Tap	Model 9/000000000010542	6311168
	6.7	IPE-SO-THO-T1	000000000010524357 Load Tap	Model 9/000000000010524	6311165
	6.4	IPE-SO-THO-T2	000000000010524358 Load Tap	Model 9/000000000010524	6311170
	6.02	IPE-PA-WAD-T10	000000000010542773 Load Tap	Model 9/000000000010542	6311167
	4.7	IPE-SO-SCA-T2	000000000010523481 Load Tap	Model 9/000000000010523	M102315

◀ ▶

**Scores for Individual Factors**

Factor	Raw Value	Case	Multiplier	Score	Error
Water Content	44	10	0.15	1.5	
CM Costs		10	0.05	0.5	
Oil Physical	2	3	0.17	0.51	
CM Count	0	0	0.05	0	
LTC THRU NEUTRAL	0	2	1	2	
LTC Operations	578	10	0.2	2	
PM Performance	.33	2	0.1	0.2	

Ready 07/17/2002 3:26 PM

Web Part Page - Microsoft Internet Explorer

File Edit View Favorites Tools Help Links Google Welcome to MyAssistant™ GIS Reports Information Central OAMS SP CMMS - MOSS eSHIP RtBaseline MOSS

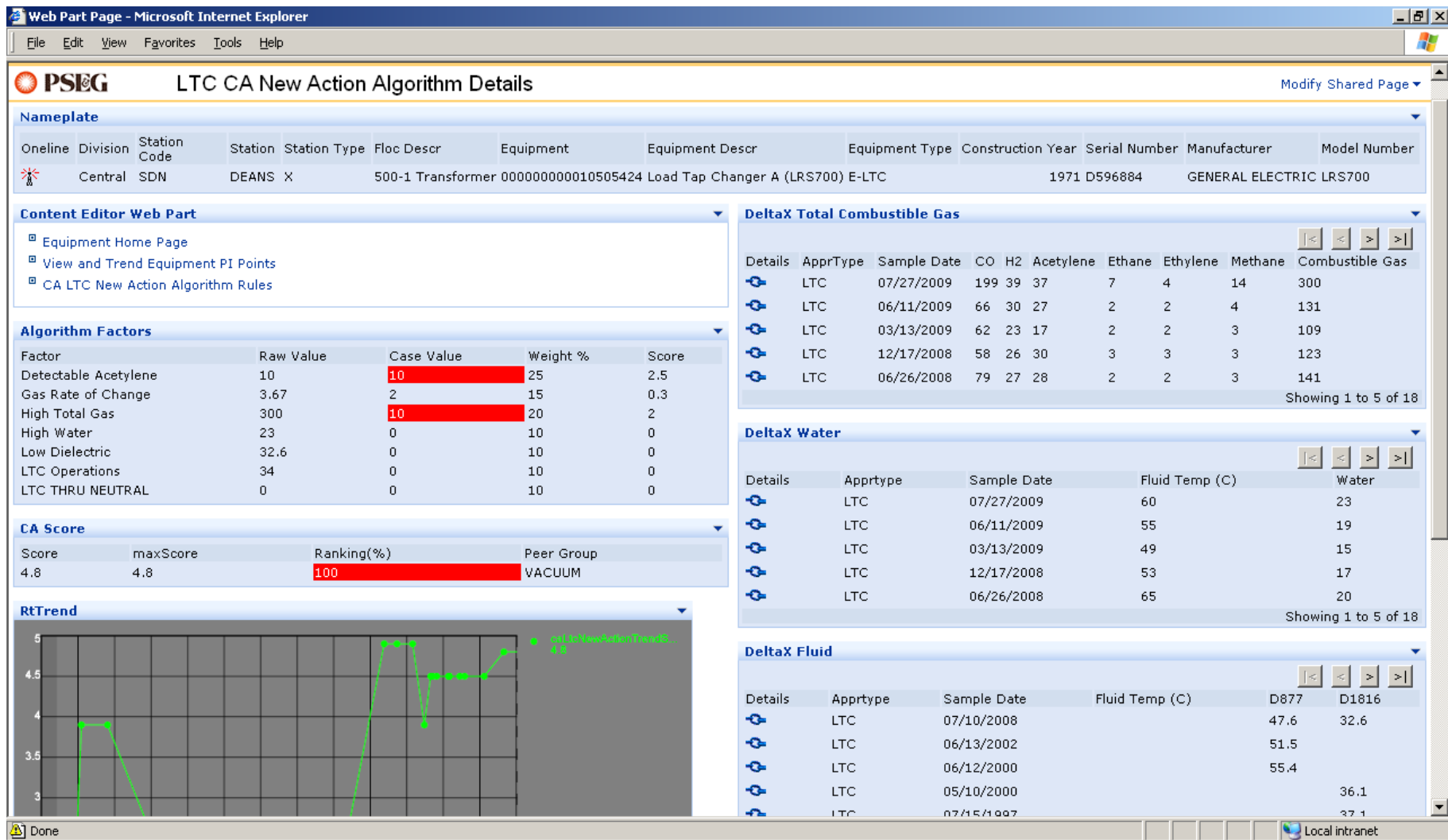
Address http://njnwkdev29/Asset%20Managment2/WebPages/LtcsCA-ActionSummaryNew.aspx

## PSE&G LTC CA-Action New Summary Report

### CA Records

Details	Division	Floc	Floc Descr	Equipment	Equip Descr	Score	Person	Status	Manufacturer	Type	ApprT
	CE	IPE-CE-SDN -1TRX	500-1 Transformer	000000000010505424	Load Tap Changer A (LRS700)	4.8	George	Pending Action	GENERAL ELECTRIC	LRS700	LTC
	CE	IPE-CE-SDN -1TRX	500-1 Transformer	000000000010505425	Load Tap Changer B (LRS700)	4.65	George	Pending Action	GENERAL ELECTRIC	LRS700	LTC
	CE	IPE-CE-SMN -1PM	132-1 Transformer	000000000010023218	Load Tap Changer 132-1	4.5	Mark	OK	WESTINGHOUSE	URT	SS
	CE	IPE-CE-DAY -UNIT 2	Unit Substation - 8002	000000000010023245	Load Tap Changer 8002	4.25	Mark	Pending Action	FEDERAL PACIFIC	TC232	LTC
	CE	IPE-CE-SCO -UNIT 1	Unit Substation - 4001	000000000010502929	Load Tap Changer	4			WESTINGHOUSE	URS	LTC
	CE	IPE-CE-SOS -T2	# 2 Transformer	000000000010503189	Load Tap Changer (URT)	4	George	Pending Action	WESTINGHOUSE	URT	TS
	ME	IPE-ME-HNC -T2	# 2 Transformer	000000000010507167	Load Tap Changer	4	Paul	ok	FEDERAL PACIFIC	550C	LTC
	SO	IPE-SO-BEA -T2	# 2 Transformer	000000000010520911	Load Tap Changer	4			FEDERAL PACIFIC	TC546	LTC
	SO	IPE-SO-MAR -T1	# 1 Transformer	000000000010522897	Load Tap Changer	4	George	Pending Action	GENERAL ELECTRIC	LRT65	LTC
	SO	IPE-SO-SLA -T1LTC	220-1 Transformer Tap Changer	000000000010526193	Load Tap Changer SEL 220-1	3.9	Mark	Pending Action	MOLONEY	SRTMHD	SS
	CE	IPE-CE-GSE -132-7	132-7 Transformer	000000000010501565	Load Tap Changer	3.85	Mark	Needs Review	WESTINGHOUSE	URT	SS
	CE	IPE-CE-SBR -3TRH	220-3 Transformer	000000000010505101	Load Tap Changer 220-3 26Kv	3.75	Mark	No action	MOLONEY	SRTMHD	TS
	CE	IPE-CE-SLI -41HL	H-2234	000000000010012268	Phase Angle Regulator-Load Tap Changer-A	3.25	Mark	Pending Action	WESTINGHOUSE	UVT	LTC
	CE	IPE-CE-SDN -2TRX	500-2 Transformer	000000000010505428	Load Tap Changer B (LRS700)	3.25	George	OK	GENERAL ELECTRIC	LRS700	LTC
	SO	IPE-SO-LAW -T2	# 2 Transformer	000000000010522332	Load Tap Changer	3.25			FEDERAL PACIFIC	TC546	LTC
	SO	IPE-SO-MRO -T1	# 1 Transformer	000000000010525854	Load Tap Changer	3.25	Mark	Pending Action	GENERAL ELECTRIC	LRT200-2	LTC
	ME	IPE-ME-HAW -T2	# 2 Transformer	000000000010507132	Load Tap Changer	3.1	Paul	OK	WESTINGHOUSE	URT	SS
	CE	IPE-CE-GSE -1TRH	220-1 Transformer	000000000010501563	Load Tap Changer	3	Mark	Pending Action	WESTINGHOUSE	UTH	TS
	PA	IPE-PA-KIN -T2	# 2 Transformer	000000000010609461	Load Tap Changer Vacuum	3			GE PROLEC	RMV II	LTC
	CE	IPE-CE-POH -T2	# 2 Transformer	000000000010504695	Load Tap Changer (UVT)	2.8	Paul	Pending Action	WESTINGHOUSE	UVT	LTC
	PA	IPE-PA-HOE -T1	# 1 Transformer	000000000010515759	Load Tap Changer A	2.8	George	Needs Review	ABB	UVT	LTC
	CE	IPE-CE-SBB -3TRX	500-3 Transformer	000000000010608858	Load Tap Changer B	2.75	George	OK	SMIT	M	SS
	CE	IPE-CE-SOS -T2	# 2 Transformer	000000000010503189	Load Tap Changer (URT)	2.65	George	Pending Action	WESTINGHOUSE	URT	SS

Done Local intranet



Home - CMMS Asset Information - Engineering Desktop - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Home Documents and Lists Create Site Settings Help Up to PSE&G Delivery

CMMS Asset Information - Engineering Desktop  
**Home** [Modify Shared Page](#)

**Quick Launch**

- Documents**
  - CE-ME
  - ME-ME
  - PA-ME
  - SO-ME
  - Asset Management
  - WebPages
  - Transformer Books
- Pictures**
- Lists**
  - Contacts
  - Events
- Discussions**
  - General Discussion
- Surveys**

**Announcements**

[New Item](#) | [Filter](#)

Title	Modified
Updated CMMS Policy and Procedures Document	8/10/2007 12:53 PM

**Discussions**

[New Discussion](#) | [Filter](#)

Subject	Posted By
■ IPE New Equipment Process Tracking SAP new equipment process via SAP notifications.	Rothweiler, Angela

**Asset Management Web Sites**

- Information Central
- Consolidated Manager
- ESOC Dashboard
- PSEG Online Applications
- CMMS Web Reports
- NYSE:PEG

**CMMS Asset Information**

- IPE Equipment Search
- Mechanical Work Priorization
- Equipment Ranking
- Relay Work Priorization
- DeltaX Gas and Fluid Tests
- ESOC System Load

**Worst Performing Assets**

- Transformers
- LTCs
- Breakers
- Circuit Switchers

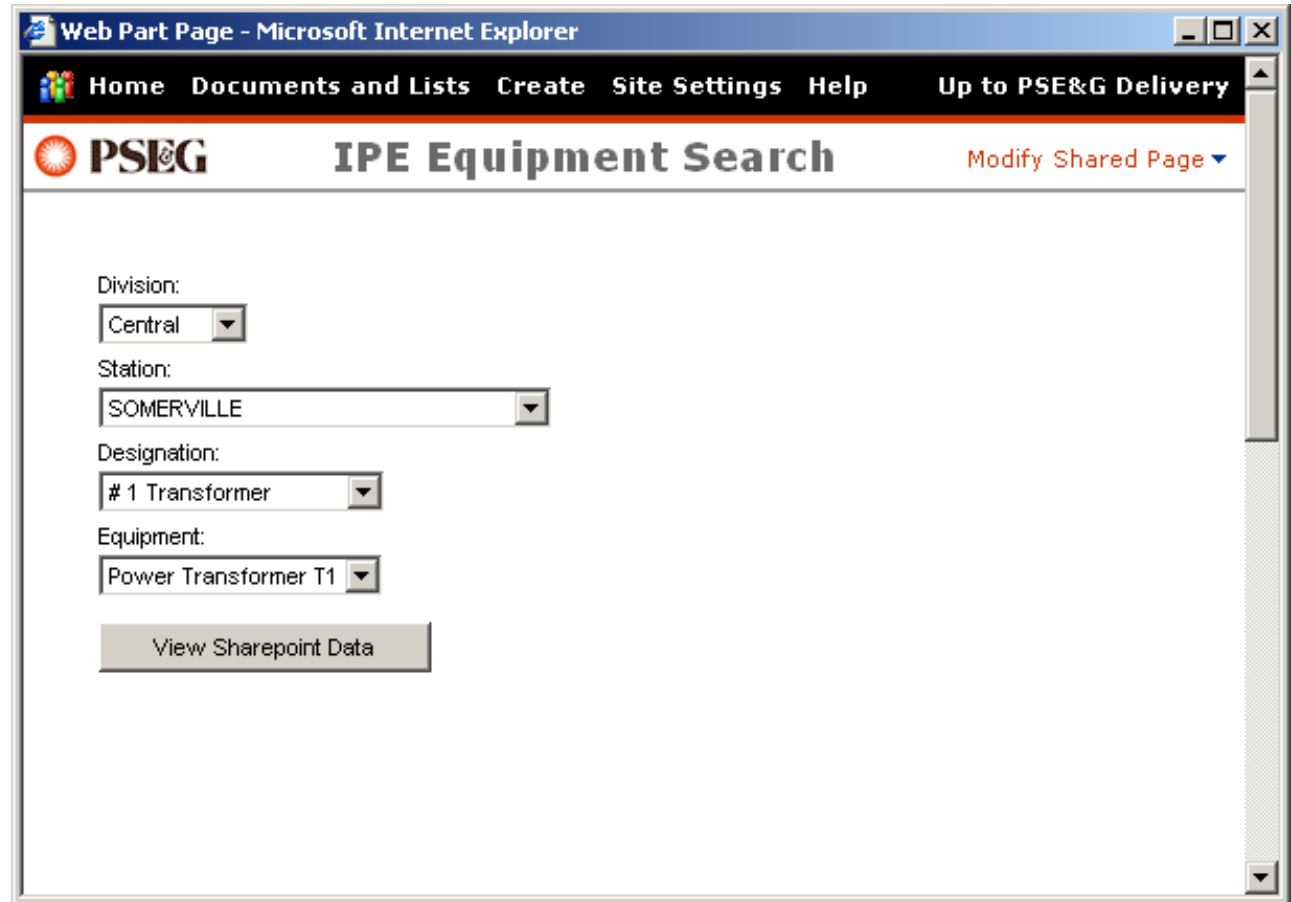
**PSEG**  
We make things work for you.

**Members**

- Andreula, Maurice G.
- Arthur, George
- Burns, Michael F.
- Daroci, Steven J.
- Dickens, Rodney L.
- Evans, David E.
- Fallon, Donald
- Fox, Michael F.
- Giamini, Vincent

Local intranet

- Search By
  - Division
  - Substation
  - FLOC
  - Equipment




The screenshot shows a web browser window titled "Web Part Page - Microsoft Internet Explorer". The address bar shows a URL starting with "http://". The page has a navigation bar with links: Home, Documents and Lists, Create, Site Settings, Help, and Up to PSE&G Delivery. Below the navigation bar is a header section with the PSE&G logo, the title "IPE Equipment Search", and a link "Modify Shared Page". The main content area contains four dropdown menus for search criteria: Division (set to Central), Station (set to SOMERVILLE), Designation (set to # 1 Transformer), and Equipment (set to Power Transformer T1). Below these menus is a button labeled "View Sharepoint Data".

Web Part Page - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Home Documents and Lists Create Site Settings Help

Up to PSE&G Delive


**Equipment Home Page**
[Modify Shared Page](#)

**Equipment Age**

Age
43

**Characteristics**

Characteristic	Value
ABC	C
CONFIG	3-PHASE
CONSTRUCTION YEAR	1964
COOLING	OA/FOA/FOA
DIVISION	CE
EQ DESCR	Power Transformer T1
EQ NUMBER	000000000010505778
EQUIP CLASS	E-TRANSF-CL
EQUIP TYPE	E-TRF-TRF
FC-AVG-COP-RISE	47.10
FC-AVG-OIL-RISE	36.30
FC-EXP-N	0.90
FC-HOT-SPOT-GRAD	14.00
FC-SUM-1MO-EMER	59.45
FC-SUM-1WK-EMER	59.06
FC-SUM-30MIN-EMER	86.58
FC-SUM-4HR-EMER	61.84
FC-SUM-NORMAL	56.52
FC-TEST-MVA	56.52
FC-TOP-OIL-RISE	36.50
FLOC DESCR	# 1 Transformer
FLOC NUMBER	IPE-CE-SMV -T1
GAL-X-1000	6.80
INST-COST	0.30
INSTALL DATE	1/1/1965

Showing 1 to 25 of 50

**Nameplate**

Division	Station Code	Station	Station Type	Floc Descr	Equipment	Equipment Descr	Equipment Type	Construction Year	Serial Number	Manufacturer	Model Number	Book No.	Open Book
CE	SMV	SOMERVILLE H		# 1 Transformer	000000000010505778	Power Transformer T1	E-TRF-TRF	1964	7000351	WESTINGHOUSE	No LTC	104	

**Latest DeltaX Gas Test**

Details	Sample Date	Equip Cond	Fluid Temp(C)	Acetylene	Ethane	Ethylene	Methane	Water	Apparatus Type
	6/6/2007 12:00:00 AM	4		0	16	3	4	5	TRN

**Condition Assessment**

Details	Score	maxScore	Ranking(%)	Peer Group	Algorithm Group
	5.8	6.2	93.5	230-344KV	Transformers
	5.54	5.6	98.6	230-344KV	Transformers-Action

**Criticality**

Details	Criticality	MaxScore	Ranking(%)
	4.6	8.05	57.1

**Weekly Inspection Data**

Details	Name	Units	Time	Value
	MAX WINDING #1 TEMPERATURE	Deg C	9/24/2007 3:00:00 PM	50
	NITROGEN PRESSURE	PSI	9/24/2007 3:00:00 PM	3
	TANK OIL LEVEL		9/24/2007 3:00:00 PM	25C
	TOP OIL TEMPERATURE	Deg C	9/24/2007 3:00:00 PM	45

**PM/CM Cost Totals**

Details	Total PM Cost	Total CM Cost	Total CM Count	CM-PM Ratio
	30703	62893	5	2.0

**Count of Open Notifications**

Details	Count
No Data	

**Next Scheduled Maintenance**

Operation	DueDate	Order Status
Transf. ( ALL ) 1 Yr. Desicant Sys. Mai	May 25 2008	OPEN
Transf. ( ALL ) 1 Yr. Cooling System. Ma	May 25 2008	OPEN
Transf. ( ALL ) 1 Yr. FOA Heat Exchanger	May 25 2008	OPEN
Transf. ( ALL ) 1 Yr. Maint. Gas in Oil	May 25 2008	OPEN

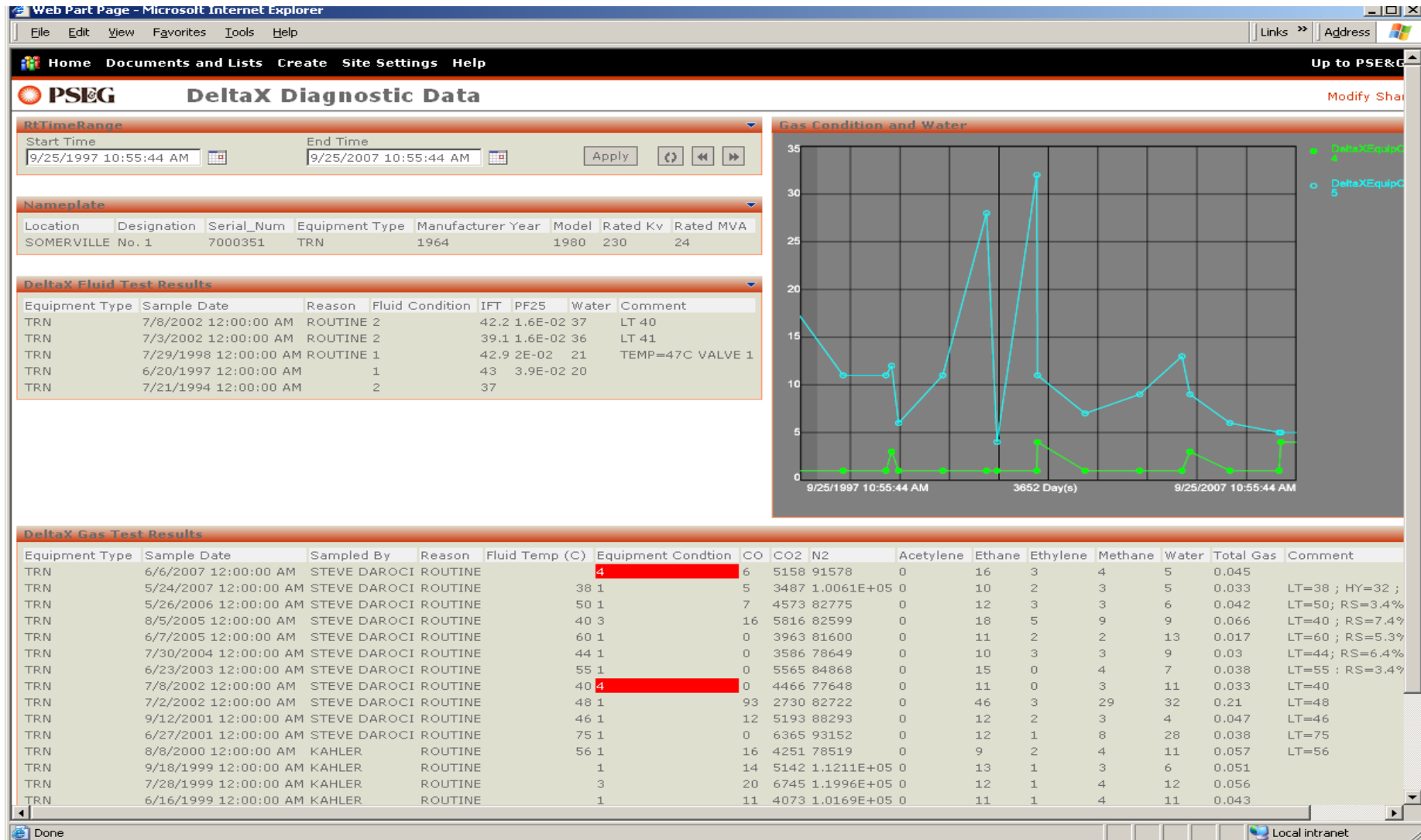
**Links**

- [View and Trend Equipment PI Points](#)

Local intranet



# Condition Assessment Detail



# Results



- Tangible
  - Annually document savings
  - First year savings!
  - 2005 - Approximately \$3MM
    - Reduced Maintenance Costs
    - Failure avoidance
  - More targeted and reduced Capital Expenditures
- Intangible
  - Platform for many other analytic efforts
  - Used for limiting component determination for critical circuits
  - Used for Work Prioritization - ensuring the right work is performed - most PM's completed annually
  - Results in quicker failure analysis
  - Most reliable electric utility nationally, regionally for last 8 years (PA Consulting)



# Thank you

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