



让PI 系统发掘企业数据蕴藏的无限潜能

## **Asset Optimization and Condition-Based Maintenance (CBM)**

### **Improving Reliability and Quality**

**资产性能最优化  
及  
实时状态检修/维护  
提升可靠性 及 性能**

Ann Moore – Business Development Executive

策略事务开发总监

# Agenda议程

- Asset Management Issues and Trends (资产管理方面的问题和趋势)
- Utility Use Cases (电力公司应用案例)
  - PSE&G CMMS
  - SDG&E RtCBM
- Benefits and ROI (效益和投资回报)
- OSIsoft Technology (OSIsoft 科技支持)
- Summary and Q&A (结语和问题与答疑)

# 资产管理演化

## 1. 传统的资产管理方法

- *Issues*问题
- *Limitations*局限性

## 2. 维护实践演化

Past Present Future



- Interval based (基于时间间隔)
  - *Time based* (基于时间)
  - *Counter based* (基于操作次数)
- Condition based (基于状态)
- Real-time Condition based (基于实时状态)
- Future Asset Management Practice (面向未来资产管理策略)

**PSE&G**

**(Public Service Electric & Gas)**

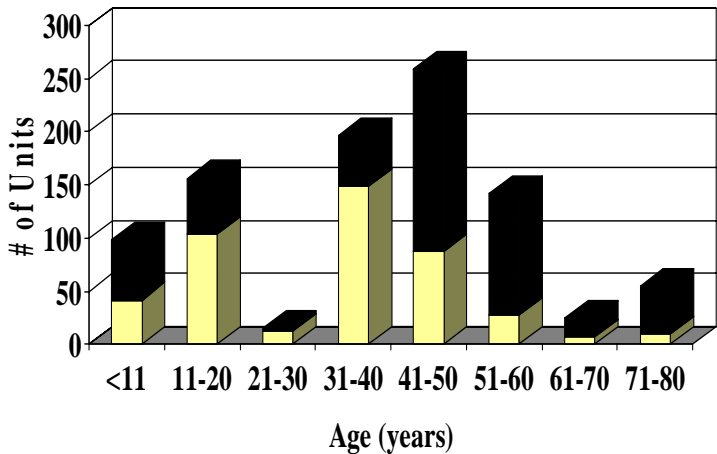
**CMMS**

**(Computerized Maintenance Management System)**

电脑化的维修管理系统

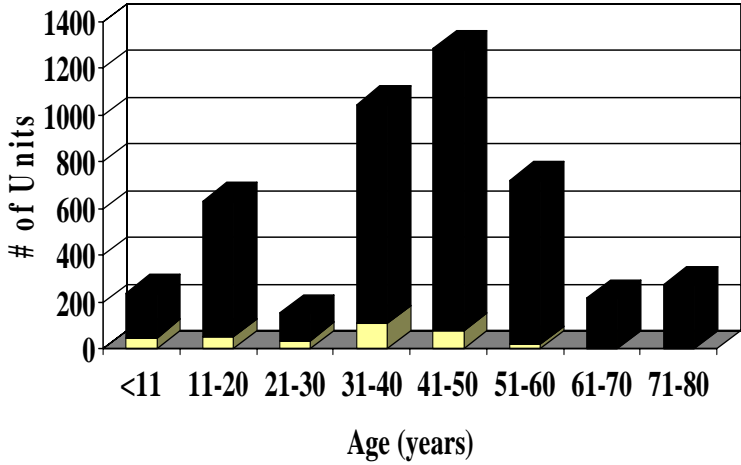
# Equipment Age Profile in Utility

Transformers 变压器  
Total - 955 units



Transmission Distribution

Breakers 断路器  
Total - 4578



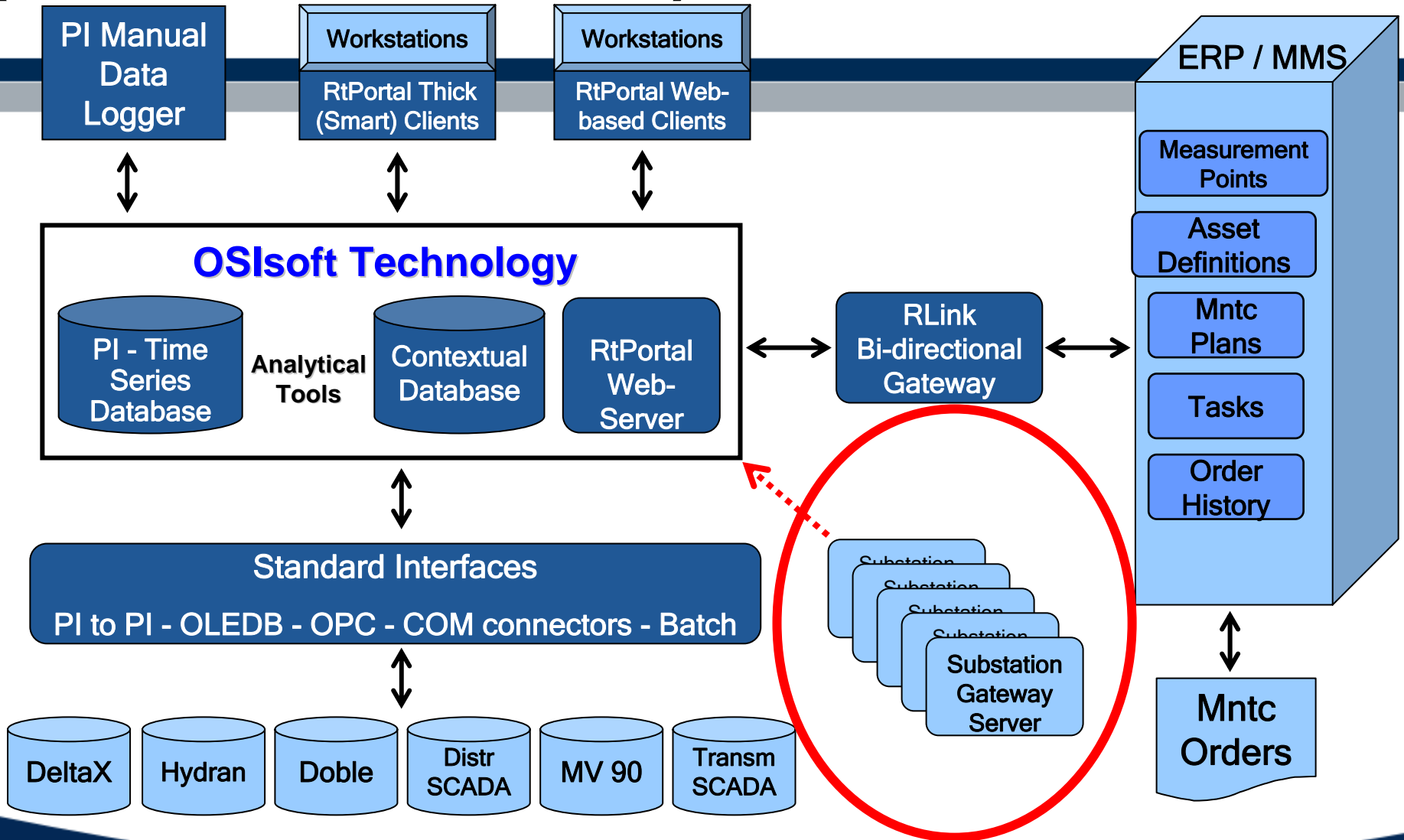
Transmission Distribution

Average Age- **37.4** Years

Average Age- **40.6** Years

# Implementation Overview

(典型的执行方式总览)



# Data Correlation(数据相关整合)

## Condition Assessment 状态评估

Score

Relational Attri

ies Points

PI Module Database Editor - Microsoft Internet Explorer

00000000010503860 Power Transformer

Folder Items

- BAY
- BEN
  - COM-RLY
  - T1
  - T2
    - 00000000010503860 Power Transformer
      - IPE-CE-BEN -T2 -7259
      - IPE-CE-BEN -T2 -7261
      - IPE-CE-BEN -T2 -7261M
      - IPE-CE-BEN -T2 -7262L
      - IPE-CE-BEN -T2 -7262V
    - BOU

PIProperty Name Value

- EQ NUMBER 000000
- EQ DESCR Power
- FLOC DESCR # 2 Tr
- FLOC NUMBER IPE-CE
- FC Summer Normal 51.19
- EC Summer Normal 33.80
- NORMAL RATING 24000
- Secondary Voltage 13
- TRF CONFIG 3-PHAS
- SERIAL NUMBER RAR66

1 Objects Type: PIModule Aliases: 5 Properties: 10 Effective Date: 12/31/1969 7:00:01 PM Query

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 9/00000000001054; A0296T	
8.41	IPE-SO-CAS -UNIT 1	000000000010520986 Load Tap	Model 9/00000000001052; A117IX	
8.41	IPE-SO-SNF -4TRX	000000000010523972 Load Tap	Model 9/00000000001052; ALM22911	
7.51	IPE-PA-MAY -T2	000000000010542731 Load Tap	Model 9/00000000001054; 6311186	
7.21	IPE-PA-MAY -T1	000000000010542730 Load Tap	Model 9/00000000001054; 6311189	
7	IPE-SO-CAS -UNIT 2	000000000010520987 Load Tap	Model 9/00000000001052; A1181X	
6.7	IPE-PA-WAD -T20	000000000010542776 Load Tap	Model 9/00000000001054; 6311188	
6.7	IPE-SO-THO -T1	000000000010524357 Load Tap	Model 9/00000000001052; 6311185	
6.4	IPE-SO-THO -T2	000000000010524358 Load Tap	Model 9/00000000001052; 6311170	
6.02	IPE-PA-WAD -T10	000000000010542773 Load Tap	Model 9/00000000001054; 6311187	
4.7	IPE-SO-SCA -T2	000000000010523481 Load Tap	Model 9/00000000001052; 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

Sub-Modules PI Aliases PI Properties

Alias Name	Tag Name	Server	Snapshot Va
ESOC LOAD IN MVA	BEN:TRF.E004.Q	rjnw.aps65	38.9892
MV90 KVAR IN	BEN:TRF.E011.Q	rjnw.aps65	0
MV90 KVAR OUT	BEN:TRF.E013.Q	rjnw.aps65	8960
MV90 KW	BEN:TRF.E017.W	rjnw.aps65	18060
MV90 VOLTS	BEN:TRF.E015.V	rjnw.aps65	120.476
OIL LEVEL	BEN:TRF.L002.M	rjnw.aps65	25C
MAX OIL TEMP	BEN:TRF.T003.M	rjnw.aps65	79
MAX WINDING TEMP	BEN:TRF.T004.M	rjnw.aps65	BROKEN
FLUID CONDITION	BEN:TRF.Q002.YX	rjnw.aps65	Pt Created
GAS CONDITION	BEN:TRF.Q004.YX	rjnw.aps65	Pt Created

12/31/1969 7:00:01 PM Query Date: 07/15/2002 11:49:22 AM

Condition Assessment =  $f_1(m_1) + f_2(m_2) + f_3(m_3) \dots + f_n(m_n)$

# Data Correlation (cont'd)

## Operational Data (运作数据)

PI Module Database Editor - Microsoft Internet Explorer

File Edit View Favorites Tools Help

00000000010047622 Power Transformer A

Folder Items

- SBB
  - 101H
  - 110X
  - 122X
  - 1T
  - 1TRX
    - 00000000010047622 Power Transformer A
    - 00000000010504816 Disconnect Switch Deluge System A
    - 00000000010504817 Disconnect Switch Deluge System C
    - 00000000010504818 Disconnect Switch Deluge System B
    - 00000000010504827 Disconnect Switch 500-1 230Kv Disc
    - 00000000010504828 Disconnect Switch 500-1 230Kv Grd
    - 00000000010504850 Disconnect Switch 500-1 BS 1
    - 00000000010504851 Circuit Switcher
    - 00000000010504852 Disconnect Switch Ground
    - 00000000010504853 Disconnect Switch Auto Ground
    - 00000000010504920 Power Transformer B
    - 00000000010504921 Power Transformer C
    - IPE-CE-SBB -1TRX -7259 Transformer Differential Relays
    - IPE-CE-SBB -1TRX -7261 BKR Trip Checks & Megger
    - IPE-CE-SBB -1TRX -7303 Transf. Tertiary Relays -
  - 230BS1
  - 230BS2
  - 230BS3
  - 230BS4

Sub-Modules PI Aliases PI Properties

PIAlias Name	Tag Name	Server	Snapshot Value
ESOC LOAD IN MVA	SBB:TRF.E003.Q	njnwaps65	498.7145
230KV MAX WINDING	SBB:TRF.T014.M	njnwaps65	65
500KV MAX WINDING	SBB:TRF.T004.M	njnwaps65	65
OIL TEMPERATURE	SBB:TRF.T032.M	njnwaps65	65
TANK OIL LEVEL	SBB:TRF.L001.M	njnwaps65	25C
TOP OIL TEMPERATU...	SBB:TRF.T001.M	njnwaps65	60
HYDRAN PPM	SBB:TRF.Q012.M	njnwaps65	37
HYDRAN ROC	SBB:TRF.Q012.N1	njnwaps65	0
220-1 GAS	SBR:TRF.Q014.M	njnwaps65	63
220-2A GAS	SBR::TRF.Q015.M	njnwaps65	142
500-1 PHASE A GAS	SBB:TRF.Q014.M	njnwaps65	118

1 Objects Type: PIModule Aliases: 11 Properties: 53 Effective Date: 12/31/1969 7:00:01 PM Query Date: 8/4/2005 1:35:49 PM Creator: piadmin ParentCount: 3

Done My Computer



# Data Correlation (cont'd)

## Characteristic Data (特性)

PI Module Database Editor - Microsoft Internet Explorer

File Edit View Favorites Tools Help

00000000010047622 Power Transformer A

Folder Items

- SBB
  - 101H
  - 110X
  - 122X
  - 1T
  - 1TRX
    - 00000000010047622 Power Transformer A
    - 00000000010504816 Disconnect Switch Deluge System A
    - 00000000010504817 Disconnect Switch Deluge System C
    - 00000000010504818 Disconnect Switch Deluge System B
    - 00000000010504827 Disconnect Switch 500-1 230Kv Disc
    - 00000000010504828 Disconnect Switch 500-1 230Kv Grd
    - 00000000010504850 Disconnect Switch 500-1 BS 1
    - 00000000010504851 Circuit Switcher
    - 00000000010504852 Disconnect Switch Ground
    - 00000000010504853 Disconnect Switch Auto Ground
    - 00000000010504920 Power Transformer B
    - 00000000010504921 Power Transformer C
    - IPE-CE-SBB -1TRX -7259 Transformer Differential Relays
    - IPE-CE-SBB -1TRX -7261 BKR Trip Checks & Megger
    - IPE-CE-SBB -1TRX -7303 Transf. Tertiary Relays -
  - 230BS1
  - 230BS2
  - 230BS3
  - 230BS4

Sub-Modules PI Aliases PI Properties

PIProperty Name	Value	Datatype
EQ NUMBER	00000000010047622	String
EQ DESCR	Power Transformer A	String
FLOC NUMBER	IPE-CE-SBB -1TRX	String
FLOC DESCR	500-1 Transformer	String
EQUIP CLASS	E-TRANSF-CL	String
EQUIP TYPE	E-TRF-TRF	String
MANUFACTURER	Smit	String
SERIAL NUMBER	220826	String
CONSTRUCTION YEAR	2004	String
INSTALL DATE	7/20/2004	String
SORT BY	1452	String
ABC	C	String
REPL-COST	2.80	String
INST-COST	0.70	String
TRANS-COST	2.10	String
FC-SUM-30MIN-EMER	560.19	String
FC-SUM-4HR-EMER	498.31	String
FC-SUM-24HR-EMER	461.10	String
FC-SUM-1WK-EMER	457.50	String
FC-SUM-1MO-EMER	449.70	String
FC-SUM-NORMAL	401.20	String
SC-SUM-24HR-EMER	285.70	String
FC-EXP-N	1.00	String
FC-HOT-SPOT-GRAD	21.80	String
FC-AVG-COP-RISE	39.50	String

1 Objects Type: PIModule Aliases: 11 Properties: 53 Effective Date: 12/31/1969 7:00:01 PM Query Date: 8/4/2005 1:35:49 PM Creator: piadmin ParentCount: 3

Done My Computer

# Algorithms (器算法)

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

# Score Generator (评分器)

**Equipment Condition Assessment Module**

File View Records Help

! Save Print Sort Asc Sort Desc Print Help

**Peer Group** BKR TEST  **Algorithm** GCB 26-69KV - ACTION

Score	FLOC	EQ Name	Description	Serial Number
2.1	IPE-PA-SBE -16FA	000000000010516999 Oil Circuit B	BKR TEST/000000000000	0139A7678-20
2.1	IPE-PA-SBE -8FB	000000000010517030 Oil Circuit B	BKR TEST/000000000000	0139A7637-20
0.9	IPE-PA-SBE -7FB	000000000010517027 Oil Circuit B	BKR TEST/000000000000	K-6566177-ZK
0.9	IPE-PA-SBE -14FA	000000000010516998 Oil Circuit B	BKR TEST/000000000000	K-6566177-WT
0.9	IPE-PA-SBE -7FA	000000000010517026 Oil Circuit B	BKR TEST/000000000000	K-6566177-ZK
0.9	IPE-PA-SBE -6FB	000000000010517024 Oil Circuit B	BKR TEST/000000000000	0141A3196-20
0	IPE-PA-SWK -41H	000000000010600558 Gas Circuit	BKR TEST/000000000000	B002910-11

**Scores for Individual Factors**

Factor	Raw Value	Case	Multiplier	Score	Error
Age	54	7	0.3	2.1	
Operations - 12m	6	0	0.35	0	
Operations - 6m	4	0	0.35	0	
Overall Score				2.1	

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# Work Prioritization (工作优先权)

Microsoft Excel - MECHworkPrioritybyDiv.xls

File Edit View Insert Format Tools Data Window PI P-SMT Help

A1 = orderNum

	A	B	C	E	G	H	I	K	L	M	N	Q	R
1	orderNum	workCenter	status	eqType	floc	desc	voltage	ca	criticality	daysLate	priority	eqRanking	
2	000100198305	PA-ME	OPEN	E-RECL	IPE-PA-RECL-ZSHOP	Pal. Recloser Control Inspection				424 B		50000.00	
3	000100307948	CE-ME	OPEN	E-BAT	IPE-CE-GED -COM-MEC	Cen. Battery (Transm.Dept.)				118 B		25000.00	
4	0001002255900	PA-ME	OPEN	E-BAT	IPE-PA-MAL -COM-MEC	Pal. Battery (Dist.Dept.)				53 B		15000.00	
5	000100270059	CE-ME	OPEN	E-RECL	IPE-CE-RECL-MIN24F -13F	Cen. Recloser Control Inspection				-22 B		5000.00	
6	000100294817	PA-ME	OPEN	E-BAT	IPE-PA-SWK -COM-MEC	Pal. Battery (Transm.Dept.)				-162 B		5000.00	
7	000100283073	PA-ME	OPEN	E-BAT	IPE-PA-SER -M1	Pal. Battery (Transm.Dept.)				-122 B		5000.00	
8	000100279368	PA-ME	OPEN	E-BAT	IPE-PA-SER -COM-MEC	Pal. Battery (Transm.Dept.)				-100 B		5000.00	
9	000100246821	ME-ME	OPEN	E-BATCHG	IPE-ME-SNVV -COM-MEC	Met. Battery Charger ( Transm.Dept.				118 1		2500.00	
10	000100246822	ME-ME	OPEN	E-BATCHG	IPE-ME-SNVV -COM-MEC	Met. Battery Charger ( Transm.Dept.				118 1		2500.00	
11	000100246625	PA-ME	OPEN	E-BATCHG	IPE-PA-MAL -COM-MEC	Pal. Battery Charger ( Dist.Dept.)				130 1		2500.00	
12	000100168685	SO-ME	OPEN	E-BKR-OCB	IPE-SO-SNF -41X	So.GCB BKR 500 KV (12yr)	500.00	2.5	6.7	784 1		1675.00	
13	000100256197	PA-ME	OPEN	E-BKR-OCB	IPE-PA-SMA -2PM	Pal.OCB BKR 138 KV (Transm. Dept.)	138.00	2.9	5.5	405 1		1595.00	
14	000100251300	ME-ME	OPEN	E-BATCHG	IPE-ME-SES -COM-MEC	Met. Battery Charger ( Transm.Dept.				94 1		1500.00	
15	000100251301	ME-ME	OPEN	E-BATCHG	IPE-ME-SES -COM-MEC	Met. Battery Charger ( Transm.Dept.				94 1		1500.00	
16	000100255379	PA-ME	OPEN	E-EMGEN	IPE-PA-SNM -COM-MEC	Pal. Emerg. Gen. w/ drive (Trans.Dept.)				53 1		1500.00	
17	000100255375	PA-ME	OPEN	E-EMGEN	IPE-PA-SWK -COM-MEC	Pal. Emerg. Gen. w/ drive (Trans.Dept.)				53 1		1500.00	
18	000100194085	SO-ME	OPEN	E-TRF-UNT	IPE-SO-COL -UNIT 3	So. Transf.-4kv -69KV (10yr)	26-4	4.1	3.4	467 1		1394.00	
19	000100188794	SO-ME	OPEN	E-TRF-TRF	IPE-SO-WRVY -T3	So. Transf.-4KV-26KV (10yr)	26-4	3.46	3.4	473 1		1176.40	
20	000100193118	SO-ME	OPEN	E-TRF-TRF	IPE-SO-AUD -T1	So. Transf.-4KV-26KV (10yr)	26-4	3.08	3	431 1		924.00	
21	000100278943	CE-ME	OPEN	E-BKR-ATB	IPE-CE-SBB -41H	Cen. ATB BKR 138KV-500KV (Transm.Dept.)	230.00	4	6.05	95 1		726.00	
22	000100220487	PA-ME	OPEN	E-BKR-OCB	IPE-PA-RFL -230BS3-4	Pal.GCB BKR 138 KV (Transm. Dept.)	230.00	1.75	5.85	260 1		716.63	
23	000100296359	ME-ME	OPEN	E-TRF-TRF	IPE-ME-GRE -T2	Met. Transf.-4KV-69KV (Dist.Dept.)	26-4	3.92	3.4	102 1		666.40	
24	000100015768	PA-ME	OPEN	E-CKTSWR	IPE-PA-SHU -20H90	Pal.Circuit Sw.-138KV-500KV(Transm.Dept)	230.00	6.5		1744 1		650.00	
25	000100255820	PA-ME	OPEN	E-TRF-TRF	IPE-PA-MAYL -T2	Pal. Transf.-138kv -500KV (Transm.Dept.)	230-13	4.44	4.4	62 1		586.00	
26	000100027784	CE-ME	OPEN	E-LTC	IPE-CE-WFL -UNIT2	Cen. Load Tap Changers 1 Yr. & 4 Yr	13	5.8		1836 1		580.00	
27	000100246700	PA-ME	OPEN	E-BKR-OCB	IPE-PA-SWK -12WV	Pal.GCB BKR 138 KV (Transm. Dept.)	345.00	1.85	6.2	121 1		573.50	
28	000100126105	PA-ME	OPEN	E-BKR-OCB	IPE-PA-SBE -90P	Pal.GCB BKR 138 KV (Transm. Dept.)	138.00	0	5.65	1202 1		565.00	
29	000100246374	ME-ME	OPEN	E-TRF-TRF	IPE-ME-SAT -132-2	Met. Transf.-138kv -500KV (Transm.Dept.)	138-26-11	3.1	3.6	107 1		558.00	
30	000100255739	PA-ME	OPEN	E-TRF-TRF	IPE-PA-MAYL -T3	Pal. Transf.-138kv -500KV (Transm.Dept.)	230-13	4.4	4.2	53 1		554.40	
31	000100278945	CE-ME	OPEN	E-BKR-ATB	IPE-CE-SBB -72H	Cen. ATB BKR 138KV-500KV (Transm.Dept.)	230.00	3.05	6.05	95 1		553.58	
32	000100193561	CE-ME	OPEN	E-BKR-OCB	IPE-CE-RAH -L1	Cen.GCB BKR 4KV-69KV (Dist.Dept.)	26.00	4	4.6	453 3		552.00	
33	000100002469	CE-ME	OPEN	E-BKR-OCB	IPE-CE-SLI -86F	Cen.GCB BKR 4KV-69KV (Dist.Dept.)	26.00	4	4.6	1256 3		552.00	
34	000100252609	PA-ME	OPEN	E-BKR-OCB	IPE-PA-SMA -3TR	Pal.OCB BKR 138 KV (Transm. Dept.)	138.00	0	5.4	405 1		540.00	
35	000100239563	SO-ME	OPEN	E-TRF-TRF	IPE-SO-CLN -T2	So. Transf.-4KV-69KV (Dist.Dept.)	26-4	3.12	3.4	143 1		530.40	
36	000100246400	ME-ME	OPEN	E-TRF-TRF	IPE-ME-SAT -132-3	Met. Transf.-138kv -500KV (Transm.Dept.)	138-26-11	2.92	3.6	107 1		525.60	
37	000100239477	SO-ME	OPEN	E-TRF-TRF	IPE-SO-BOR -T1	So. Transf.-4KV-69KV (Dist.Dept.)	26-4	3.08	3.4	156 1		523.60	
38	000100239574	SO-ME	OPEN	E-TRF-TRF	IPE-SO-LIB -T2	So. Transf.-4KV-69KV (Dist.Dept.)	26-4	3.08	3.4	143 1		523.60	
39	000100251265	ME-ME	OPEN	E-BKR-OCB	IPE-ME-SES -20H	Met.GCB BKR 138 KV (Transm. Dept.)	230.00	2.75	6.3	83 1		519.75	
40	000100251133	CE-ME	OPEN	E-BKR-OCB	IPE-CE-SBB -92X	Cen.GCB BKR 138 KV (Transm. Dept.)	500.00	2.5	6.8	97 1		510.00	
41	000100224948	SO-ME	OPEN	E-BKR-OCB	IPE-SO-GSA -30X	So.GCB BKR 500 KV (12yr)	500.00	0	7.25	263 1		507.50	
42	000100274255	CE-ME	OPEN	E-FHYD	IPE-CE-SBR -COM-MEC	Cen. Misc.Fire Fight Equip(Trans.Dept.)				-73 1		500.00	

Ready

CAPS NUM

# ACE (Advanced Computing Engine)

## 高级计算引擎

- Groups equipment by aliases in PI Module
- Apply set of equations to groups of equipment
- Generate email notifications or trigger for transfer of measurement docs or creation of notifications
- Event-based and periodic calculations
- Easily turn on or off equations for individual equipment
- 55 class modules and over 6000 contexts

# Notification Calculations

## 自动通知报告的计算

- Hydran PPM Rate of Change
- Excessive LTC Operations
- Excessive Runtime Readings
- High Breaker Temperatures
- Breaker Filling Pressure
- High or Low Transformer Oil Levels
- Low Transformer Nitrogen Cylinder Pressure
- Low Transformer Nitrogen Pressure

# Interfacing with Data Sources

## (各方数据来源的集成)

- SAP PM Module
- Lab Systems – DeltaX & Doble
- Breaker Diagnostic Data Web Pages
- Transmission SCADA
- Distribution SCADA
- MV-90 13kv Transformer Load Data
- SDC 4-26kv Metering
- Hydran Transformer PPM Monitoring
- SAP PM Measurement Documents

# CA Tangible Results

## 状态评估有形的效果

- 2003 石油诊断信息目标为16 LTC's, 5个有联系问题
  - Estimated Cost Saving ~ **\$300,000**
- 2004 目标为10个LTC's, 1个有导致主要故障的潜在可能
- 2004 目标为5个变压器, 2个被确定为有重要问题
  - Estimated Cost Saving > **\$1.2M**
- 2005 Cost Savings > **\$2M**



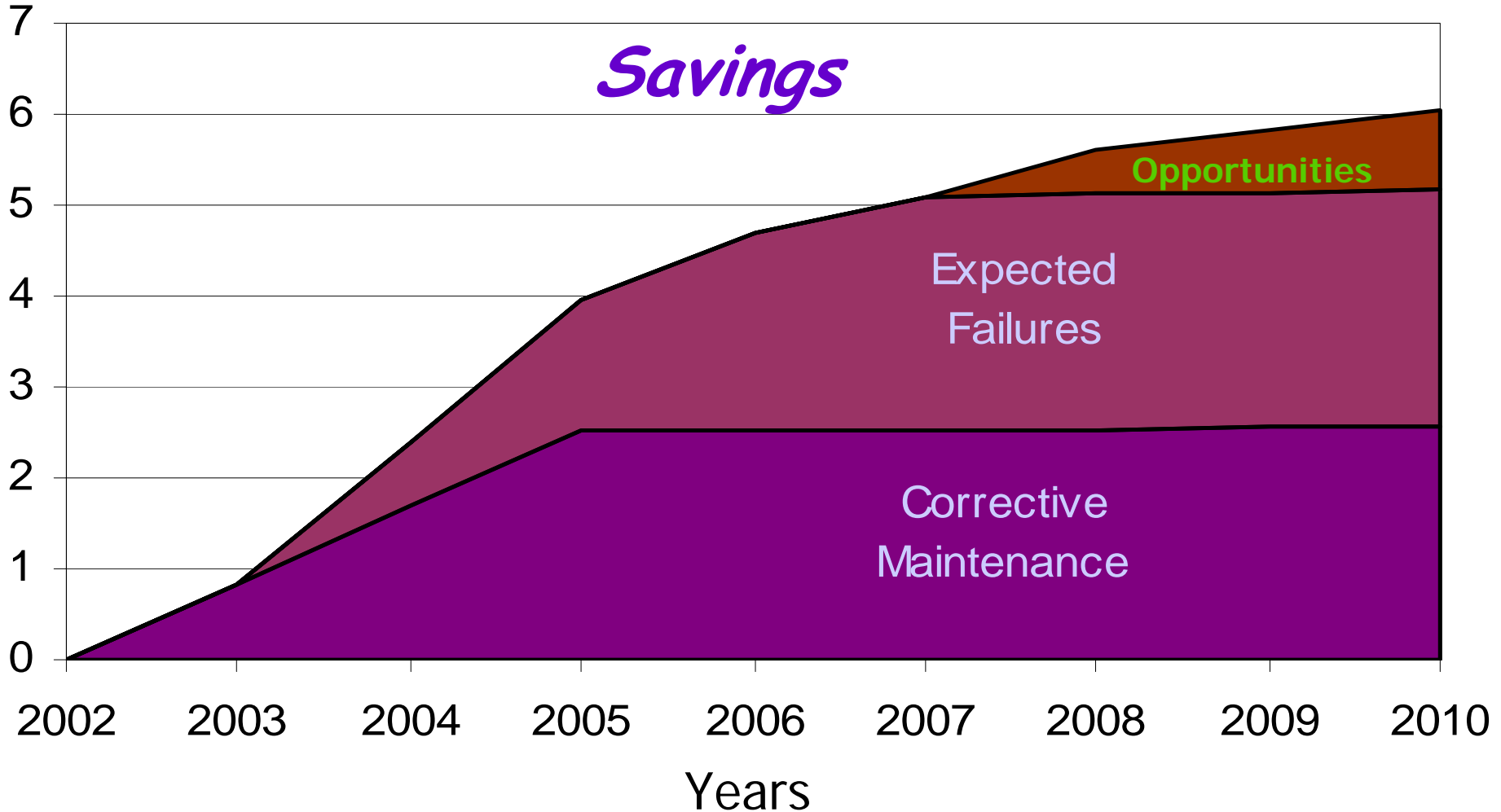
# Notification Tangible Results

## 通知报告有形的效果

- Problems discovered from CMMS Notifications
  - Controls out of Calibration
  - Leaky Blast Values
  - Incorrect CMV Setting
  - Defective Controls on older LTC
  - Defective Counters
  - Low Oil Levels
  - Cylinder Leaks
  - Hydran PPM
- 2003 Estimated Cost savings for 9 LTC's and 2 GCB's is **\$264,600**
- 2004 Estimated Cost saving for 5 Transformers is **\$800,000**
- **2005 Cost Savings > \$1M**

# Conclusion: Proactive Approach Enables:

\$ (Million)



**SDG&E**

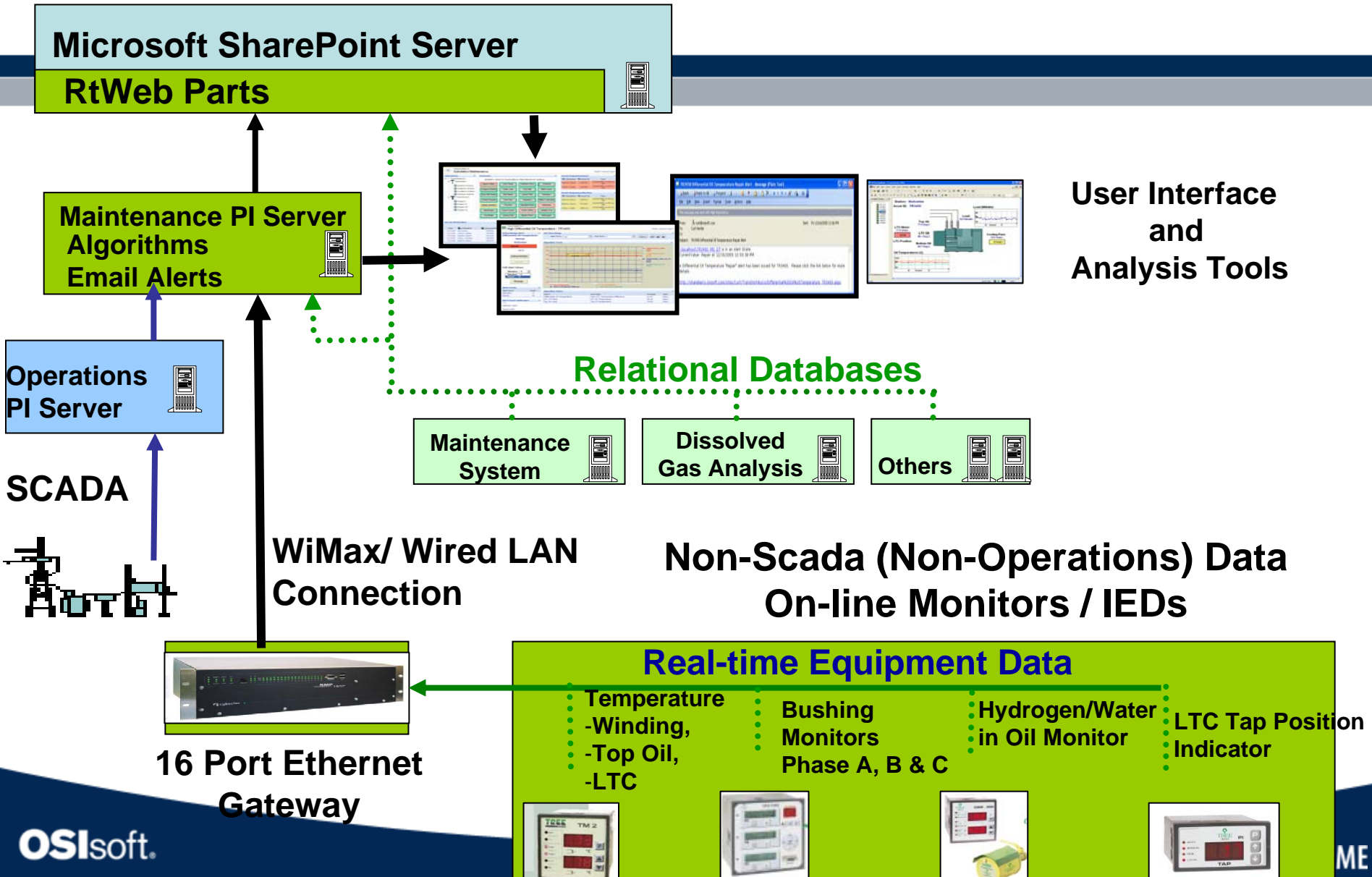
**(San Diego Gas & Electric)**

**RtCBM Program**

**(Real-time Condition Based Maintenance)**

**实时状态检修/维护**

# SDG&E RtCBM Architecture 架构



# RtCBM 数据集成

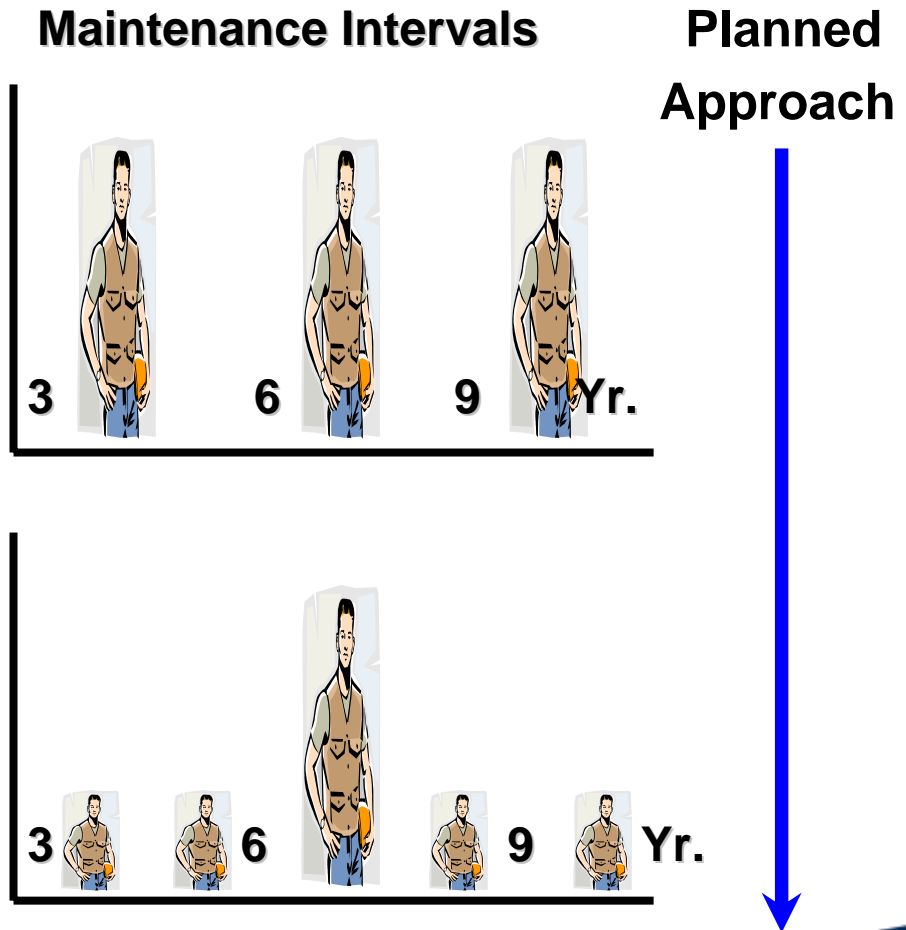
- Weekly general inspections 每周常规检查
  - LTC operations LTC操作
  - Alarms, temperature, visual 报警、温度、图像
- Monthly equipment inspections 每月设备检查
  - Operation counters 操作计数
  - Temperature, Pressure 温度、压力
  - Voltage 电压
  - Functional check 功能检查
- General Asset Data 普通资产数据
  - Rating 定额
  - Age, Type, Design 年限、类型、设计
  - Operating limits 操作限制
- Operational data 可操作数据
  - Relays & Digital fault recorders 继电器 & 数字错误记录
  - PQ Monitors PQ监控
- Specific Equipment Data 特定设备信息
  - Operating conditions 操作状态
  - Stress factors 压力因素
  - Trouble History 历史故障
  - Maintenance data 维护数据
  - Oil test data 石油测试数据
  - Electrical test data 电力测试数据
  - Operating speed 操作速度
- Real-time data 实时数据
  - Voltage & Current 电压 & 电流
  - Temperature 温度
  - Bushing On-line Power Factor 在线功率因数
  - Hydrogen in Oil 石油中氢含量
- Simulated data (modeling) 模拟数据 (模型)
- Other system & engineering data 其它系统 & 工程数据

# Time-based to RtCBM – Circuit Breakers

## 基于时间 至 RtCBM- 断路器

### Data Available 数据有效性

- Weekly safety inspections 每周的安全检查
- Monthly equipment insp. 每月的设备检查
- Asset Data 资产数据
- Historical Data 历史数据
  - Operating conditions 操作状态
  - Stress factors 重点因素
  - Trouble 故障
  - Maintenance data 维护数据
  - Test data (insul & elec) 测试数据
- Operational data 可操作数据
  - Relays & Digital fault recorders 继电器 & 数字错误记录
  - PQ Monitors PQ (有/无功) 监控
- Real-time data 实时数据
  - Voltage & Current 电压 & 电流
  - I<sup>2</sup>T and Contact Wear I<sup>2</sup>T 以及接触磨损
  - Operations Counter 操作计数



# Circuit Breaker Operations

## 断路器操作

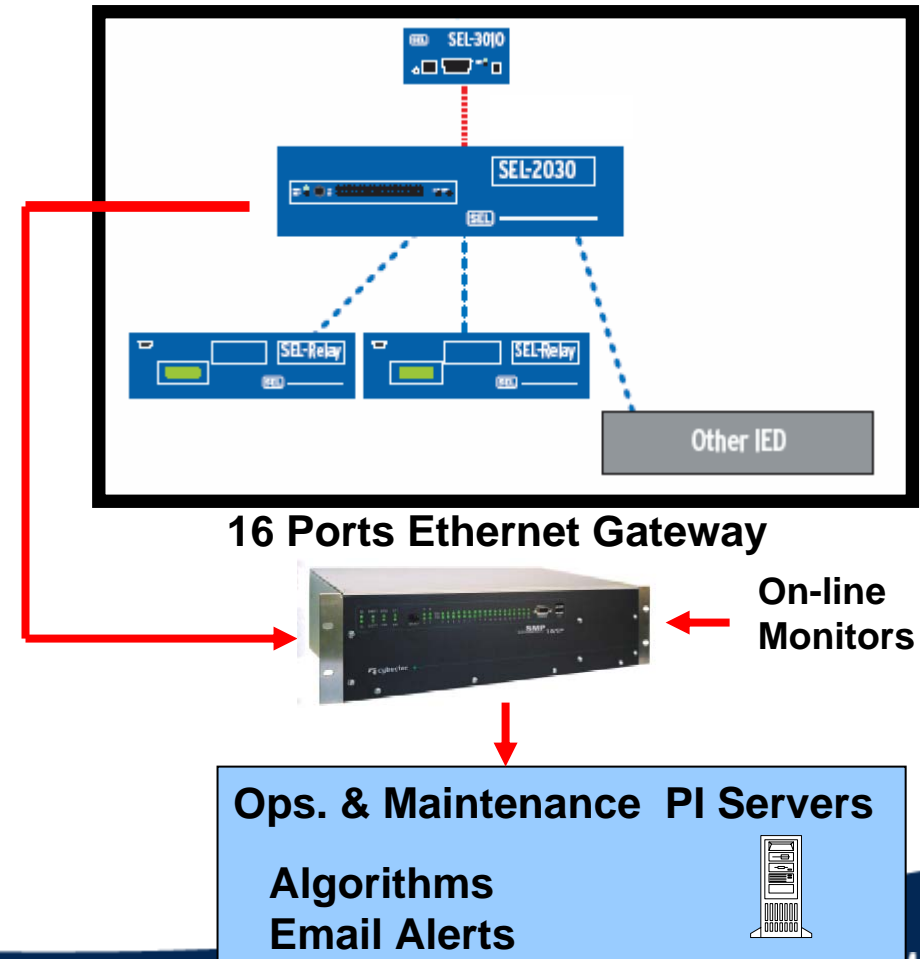
### 关注

- Proper fault clearing 适当的故障清除
- Fault testing with a circuit breaker 用断路器做故障测试

### 方案

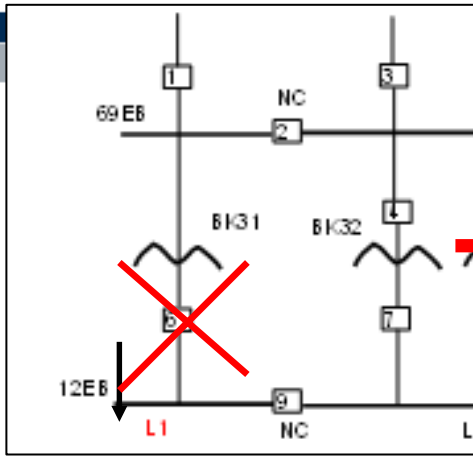
- **Verify the health of CB 检验CB的性能**
  - Contact wear 接触磨损
  - Insulation medium integrity 绝缘介质完整性
  - Bushings and accessories 套管及配件
  - Operating history 历史操作
- Use historic and real time contact wear data ( $I^2T$ ) to make a decision 使用历史和实时接触磨损数据( $I^2T$ ) 来做决策

### Substation Relays with Circuit Breaker Monitor



# Transformer at Emergency Rating

## 紧急状态等级的变压器



### 变压器性能检测

- **Insulation Power Factor** 功率因数
- **LTC Application & Design**  
LTC设计及应用
- **Oil Conditions** 变压器油状态
- **Bushing & Accessories** 套管和附件
- 操作记录及状态

### Paper Insulation Health

Location of Paper Sample	Degree of Polymerization (DP)
NLTC – Phase A	586
NLTC – Phase B	737
69kV Bushing C	688

**New Insulation Paper:**

**1000 < DP<sub>v</sub> < 1300**

**Middle Aged Insulation Paper:**

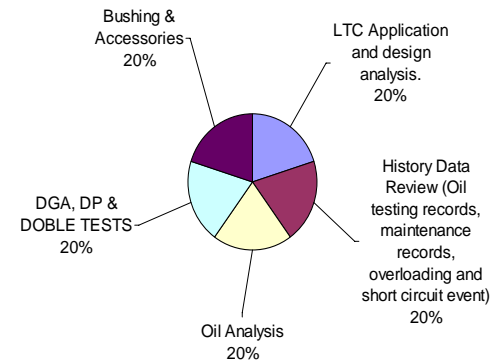
**DP<sub>v</sub> = 500**

**Old Age Insulation Paper:**

**DP<sub>v</sub> < 251**

**Severely Degraded Insulation Paper:**

**DP<sub>v</sub> < 151**





# Transformer at Emergency Rating

## 紧急状态等级的变压器

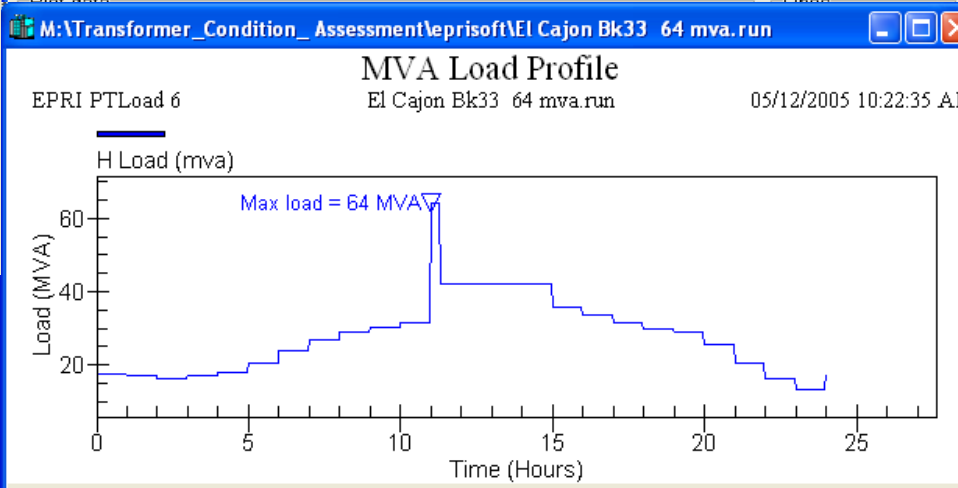
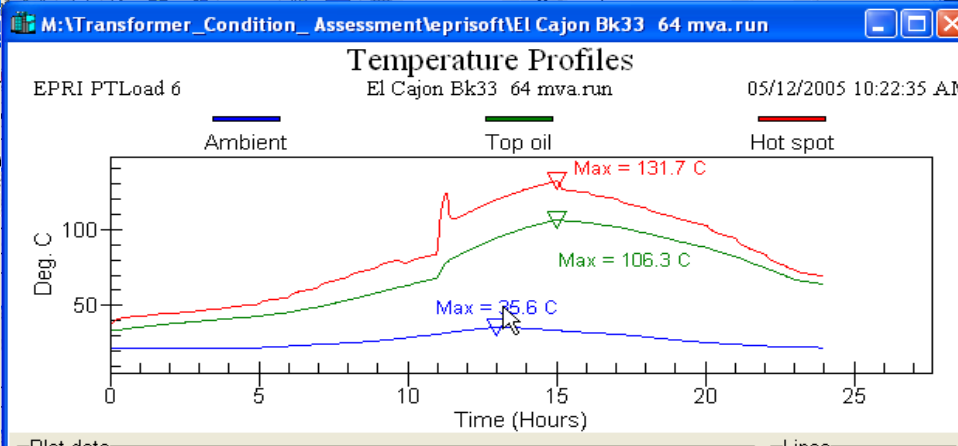
PTLOAD-Design - ...ion\_Assessment\prisoft\El Cajon Bk33 64 mva.run

File Edit Tools Options Help

Transformer Cooling Ambient Load Bubbles Calc Results  
Cycle Cycle Type

**A. OUTPUT SUMMARY**  
 Date of Calculation = 05/12/2005 10:22:35 AM  
 Number Iterations = 6  
 Limiting factor = Fixed upper limit  
 Contingency Load (Amps) = 2963.145  
 Peak Load (MVA) = 64  
 Peak Load (Amps) = 2963.145  
 Peak Load (PU) = 2.285714  
 \*\* Warning: ratings in excess of 2.0 P.U. are not supported by IEEE guidelines and the results may be unreliable.  
 Max Hot Spot (Deg C) = 131.64  
 Max Top Oil (Deg C) = 106.19  
 Peak Age Accel Factor = 8.1068  
 Cumulative % Loss of Life = 0.01401  
 Max Bubble Risk (mmHg) = -799.5175

Bubbles are not likely to form given the temperature and load profile



### Comparison of hot spot rise over top oil simulated versus actual

	Top Oil	Hot Spot	LOL
IEEE	105	176	.149
Ptload	105	145	.039
Actual HS rise	106	131	.014

**Decision: Based on Transformer Unit Health and Real Time Conditions**

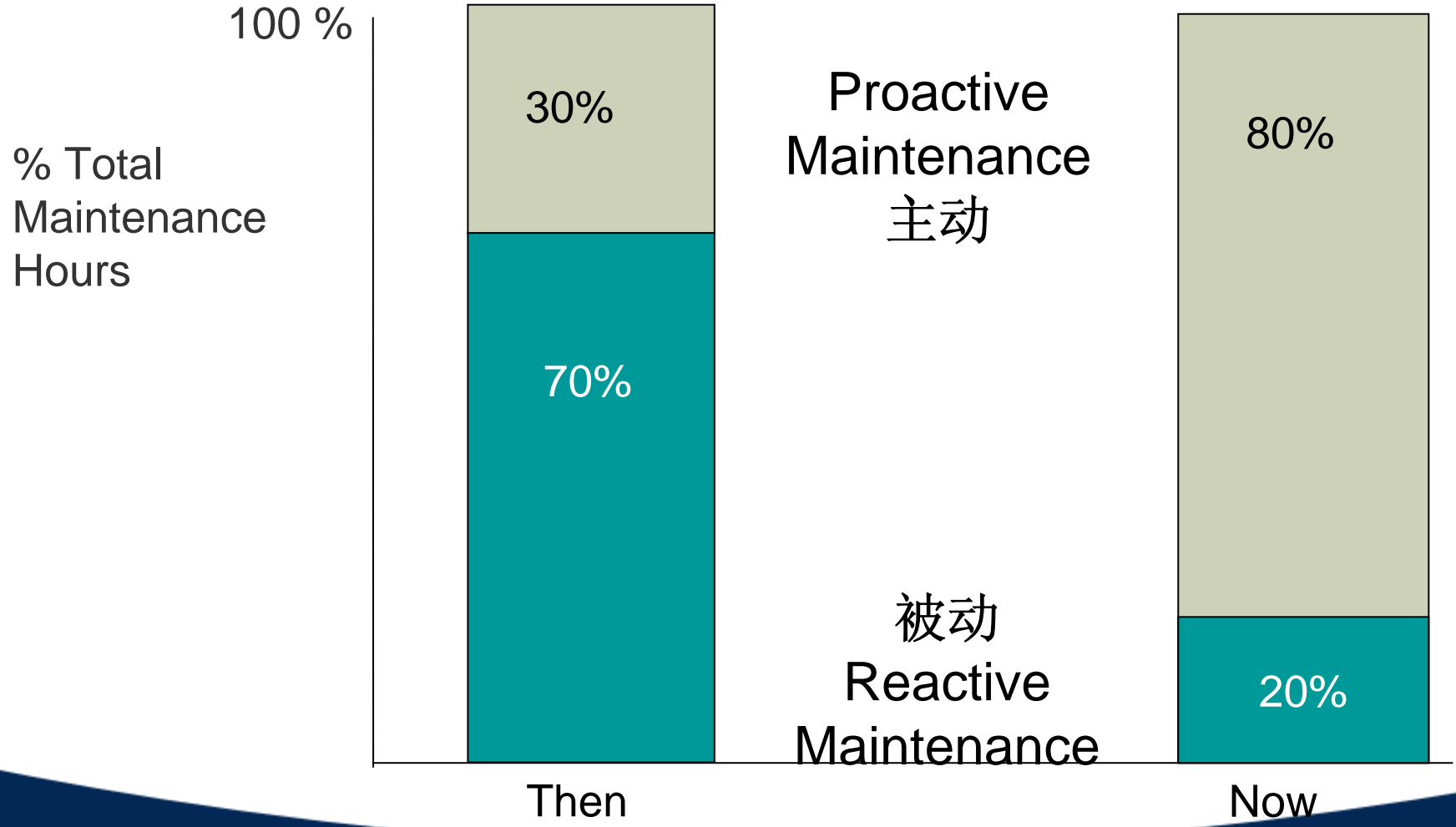
决定：取决于变压器的各部件性能和实时状态

# More PI Customer Testimonials/ROI

更多 **PI** 系统用户的见证和投资回报

# Dofasco's Change in Maintenance Culture

## 78% to 91% Equipment Availability 设备可用性



# Dofasco-Canada, Reliability Manager

## 提升可靠性

“In Blast Furnace #4, we have extended the furnace campaign from 8 years to 15 years, resulting in a savings of \$1MM per year, or **\$7 MM** for 7 years. For Blast Furnace #3 we have extended the campaign from 8 years to 20 years, resulting in a savings of \$1MM per year, which results in a savings of **\$12MM** for 12 years. The projected savings are **\$19 MM** just for this case...”



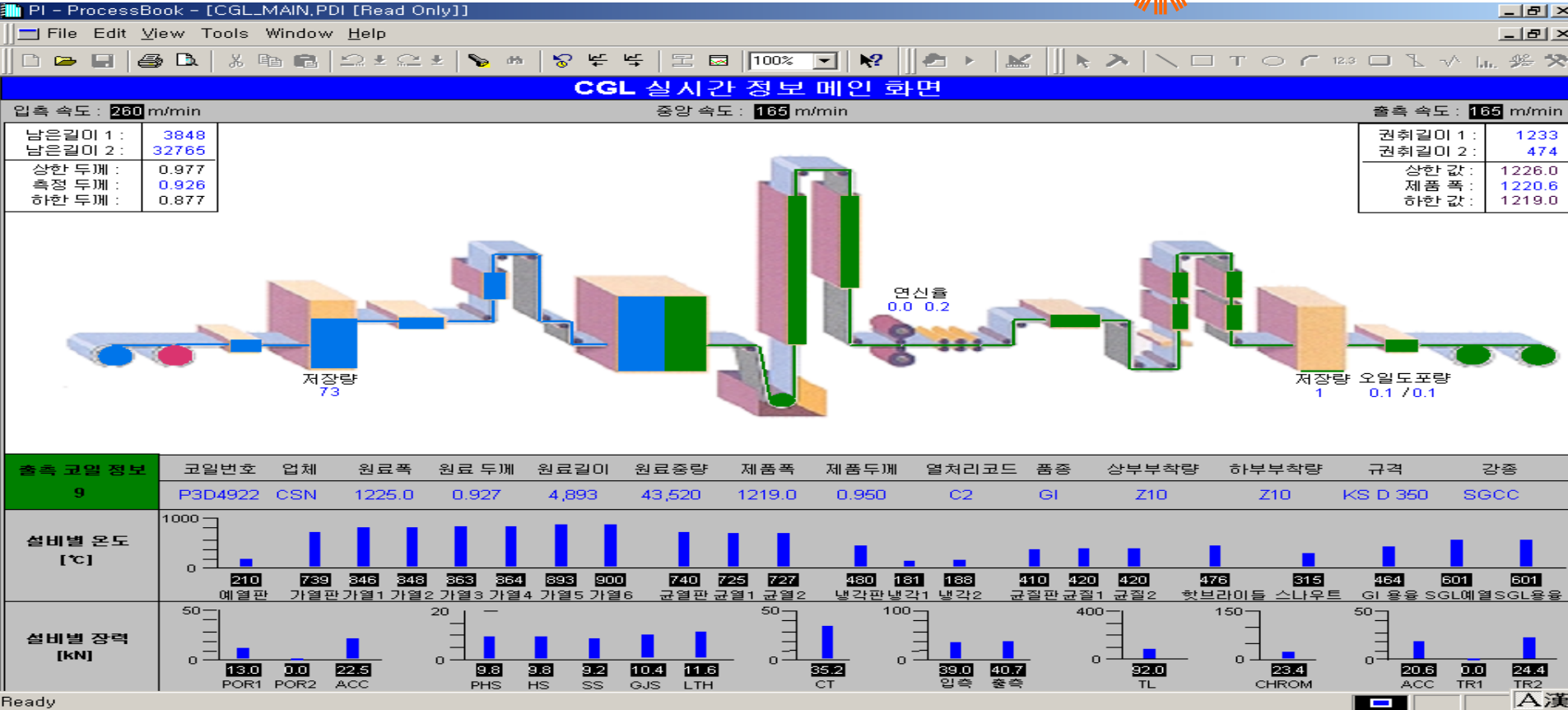
**Vlad Djuric,**  
**Reliability Manager**  
**Dofasco, Canada**

# Reduce Costs and Improve Quality

## 降低成本和提高性质



DONGBU STEEL



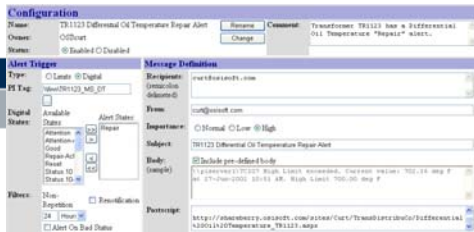
### Major Measuring Devices

- \* Thickness Gauge
- \* Zinc Coating Weight
- \* Furnace Thermometers
- \* Tension Meters
- \* Pin Hole Detector

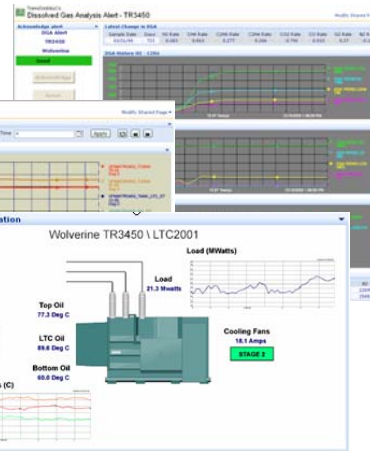
# OSIsoft Enabling Technology

OSIsoft 科技支持

# PI RtCBM 过程



**Alert Notification  
(PI Notification  
RtAlerts) 报警通知**



**Integrated Asset  
Information  
资产信息集成  
(RtWebParts)**



**Real-time Rule  
Assessment  
(PI ACE)**



**Disolved Gas Analysis**

Sample Date	H2	CH4	C2H6	C2H4	C2H2	CO2	CO
09/26/90	193	115	137	38	<-1	3004	223
08/01/94	279	185	164	51	<-1	4213	341
03/06/95	489	399	320	109	<-1	1652	315
03/28/96	1258	1980	590	369	<-1	6524	530
03/21/98	1390	2568	790	561	<-1	5952	554



**Asset Information 资产信息  
Structure  
(MDB and AF)**

**TransDistribuCo - Asset Maintenance Report**

Reporting Period: 12/05/05 04:04 PM through 02/03/06 04:04 PM

Asset ID: TR3450 Substation: Wolverine

Serial No. Manufacturer Year Model MVA Rating kV Rating Fluid Capacity  
X9945 SEIMENS 1959 G-4567 50 120 3440

Time In Hours	Maintenance Algorithm Status Summary			
	Good	Attention	Repair	Repair (ACK)
Asset Status	Good	Attention	Repair	Repair (ACK)
Differential Oil Temperature	0	2	999	414
Elevated Oil Temp	0	23	999	414

**Station Reliability**

Asset	Good	Attention	ack	Repair	ack
TR6676	0.0%	0.0%	100.0%	0.0%	
TR5493	100.0%	0.0%		0.0%	
TR4085	100.0%	0.0%		0.0%	
TR3450	0.0%	1.2%		98.8%	
TR1123	100.0%	0.0%		0.0%	

Showing 1 to 5 of 6

**Asset Reliability  
资产可靠性  
(PI OLEDB and  
RtReports)**

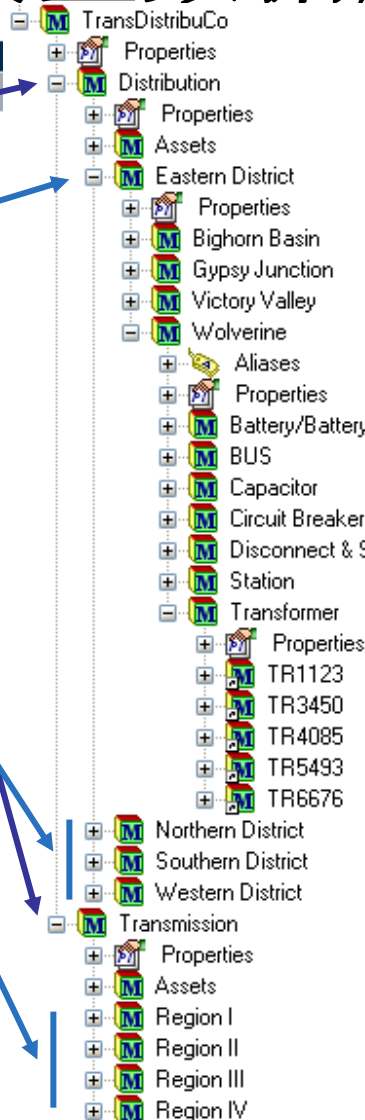
**Improve Reliability  
提高可靠性**

# Data Structure – Module Database Hierarchy

## 数据结构 - 模型数据库层次

**Division Level**  
类型划分级别

**District Level**  
区域划分级别



**Site**  
站点

**Asset Class**  
资产类型

**Individual Asset**  
单独资产



TransDistribuCo

- Models
  - Element Templates
    - Distribution Circuit Breakers
    - Distribution Load Tap Changers
    - Distribution Transformer
      - Transformer
  - Elements
    - Distribution Transformer
      - AF Example
        - TR2003
        - TR3045
        - TR3450
  - Transfers
  - Tables
  - Categories
  - Plug-Ins

TR2003  Show Categories

	Name	Value	Value Type	Data Reference	Settings
<div style="border: 1px solid black; padding: 2px;"> <span style="font-size: 1.2em;">&lt;</span> None <span style="float: right;">&gt;</span> </div>					
	Asset ID	TR2003	String	<None>	
	Substation	Bighorn Basin	String	<None>	
<div style="border: 1px solid black; padding: 2px; background-color: #ffffcc;"> <span style="font-size: 1.2em;">&lt;</span> DGA <span style="float: right;">&gt;</span> </div>					
	Acetylene	<1	String	Table Lookup	SELECT [Acetylene (C2H2)] FROM D
	Carbon Dioxide	3004 ppm	Double	Table Lookup	SELECT [Carbon Dioxide (CO2)] FROM
	Carbon Monoxide	123 ppm	Double	Table Lookup	SELECT [Carbon Monoxide (CO)] FRO
	Ethane	137 ppm	Double	Table Lookup	SELECT [Ethane (C2H6)] FROM DGA
	Ethylene	38 ppm	Double	Table Lookup	SELECT [Ethylene (C2H4)] FROM DG.
	Hydrogen	294 ppm	Double	Table Lookup	SELECT [Hydrogen (H2)] FROM DGA
	Methane	121 ppm	Double	Table Lookup	SELECT [Methane (CH4)] FROM DGA
	Nitrogen	22698 ppm	Double	Table Lookup	SELECT [Nitrogen (N2)] FROM DGA \
	Oxygen	2340 ppm	Double	Table Lookup	SELECT [Oxygen (O2)] FROM DGA \w
	TDCG	813 ppm	Double	Table Lookup	SELECT [TDCG (ppm)] FROM DGA \w
	Total Gas	2.89000010490417 %	Double	Table Lookup	SELECT [Total Gas (%)] FROM DGA \
<div style="border: 1px solid black; padding: 2px; background-color: #ffffcc;"> <span style="font-size: 1.2em;">&lt;</span> SCADA <span style="float: right;">&gt;</span> </div>					
	Bottom Oil Temperature	57.8393478393555 °C	Double	PI Point	\\Finn\TR2003_TI3886
	LTC Oil Temperature	64.3732833862305 °C	Double	PI Point	\\Finn\TR2003_TI6883
	Top Oil Temperature	81.3233795166016 °C	Double	PI Point	\\Finn\TR2003_TI4857

# Web-based Visualization Hierarchy

## 基于Web的视觉化层次

Level 1

Maintenance  
Overview

Level 2

Site  
Detail

Site  
Detail

Site  
Detail

Site  
Detail

Level 3

Asset  
Detail

Asset  
Detail

Asset  
Detail

Level 4

Rule  
Detail

Rule  
Detail

# Maintenance Overview – Level 1

## 第一层 维护综述



TransDistribCo  
Substation Maintenance

Modify Shared Page ▾

### Substations ▾

- TransDistribCo
  - Distribution
    - Eastern District
    - Northern District
    - Southern District
    - Western District
  - Transmission
    - Region I
    - Region II
    - Region III
    - Region IV

### Overview ▾

#### Eastern District Substation Maintenance Status

Bighorn Basin	Ivory Tower	Freedom Point	Yorkshire
Hungton Estates	Antler Lane	City Hall	Miller Arena
East 45th Street	Elm Street	Lincoln Park	Nicetown
Cental Hospital	York Park	Redwood	Water Treatment
Gypsy Junction	Thornhill	Mayfield Road	Wolverine
Washington	Crown Center	Victory Valley	Lobster Cove
3rd Street	Joshua Tree	Bakers Point	Wilmington

### Assets Requiring Repair ▾

Substation	Asset ID	Time
Bighorn Basin	TR3045	3/29/2006 8:35:10 AM
Bighorn Basin	CB1992	3/29/2006 2:35:10 PM
Victory Valley	TR9946	3/29/2006 2:40:20 PM
Wolverine	TR3450	3/29/2006 2:40:25 PM

### Assets Requiring Attention ▾

Substation	Asset ID	Time
Bighorn Basin	CB2033	3/29/2006 2:35:10 PM
Victory Valley	CB9376	3/29/2006 2:40:20 PM

### Substation Reliability History ▾

Substation	Good	Attention	Repair
Victory Valley	0.00%	0.00%	100.00%
Wolverine	0.00%	2.47%	97.53%
Gypsy Junction	0.00%	0.00%	0.00%
Bighorn Basin	0.00%	0.00%	100.00%

### Recent Workorders

Date	Substation	EquipmentID	Order No	Task	TaskType	Comments	Assigned To
7/3/2005	Bighorn Basin	TR3045	2004-4926	N2 CYL REPLACEMENT	New Installation	Please pump water	Davis, Ron
7/3/2005	Bighorn Basin	TR3045	2002-1234	NEW SETUP MAIN TANK	New Installation		Jones, Sarah
7/3/2005	Gypsy Junction	TR4522	2004-5629	OIL LEAK - INSPECTION	Other Maintenance		Davis, Ron
7/3/2005	Wolverine	TR3450	2004-4926	DOBLE TEST - MX	Preventive Maintenanc		Jones, Sarah
7/3/2005	Gypsy Junction	TR4522	2002-1234	N2 SYSTEM REPAIR	Other Maintenance		Rogers, Joe

Showing 1 to 5 of 32

# Site Detail – Level 2 第二层 站点细节

**Station Assets**

- Circuit Breaker
- Load Tap Changer
- Transformer
  - TR1123
  - TR3450
  - TR4085

**Field Inspection**

Type	Date
	9/30/1989
	4/11/1972
	7/18/1963
	2/7/1958

**Recent Wolverine Workorders**

Date	Equipment
1/5/2005	CB5095
1/16/2005	TR3450
1/16/2005	CB5095
2/2/2005	TR3450
2/5/2005	TR3450

**Station Contacts**

First	Last	Mobile
Albert	Fredericks	(440)-555-1212
Bill	Jones	(440)-555-1120

**Assigned To**

- Jones, Sarah
- Davis, Ron
- Saumuels, Tom
- Rogers, Joe
- Krupp, Robert

**Document Content:**

Type Inspection: TRANS/LTC UPLD. NO. \_\_\_\_\_ ORDER NO. \_\_\_\_\_

Make: TR1123 PH: \_\_\_\_\_ Polarity: Add. Sub. T1 Volts: 122

Weight: \_\_\_\_\_ Rad. Cal. \_\_\_\_\_ MVA: \_\_\_\_\_ Ser. No: 458 V13 Date: 9/30/89

Rec'd From: \_\_\_\_\_ Located in Sub: \_\_\_\_\_ Area: \_\_\_\_\_

**Electrical Tests**

Winding Insulation	Temp. °C						Results Attached						Humidity					
	F	L	F	L	F	L	F	L	F	L	F	L	F	L	F	L		
Temp Correction Factor																		
Pos. KV																		
MA																		
MW - W																		
MAF																		
#																		
Calculated Watts																		
Pos																		
H-G																		
H-Gnd																		
L-G																		
L-Gnd																		
H-L																		
H-L Gnd																		
L-L																		
L-L Gnd																		
H-L																		
H-L Gnd																		
L-L																		
L-L Gnd																		

**Burning Insulation**

Temp. Correction Factor	Type	KV	Company	Member

**OS - By Tanks**

KV	Main Tank			PCB			PPM			Moisture @ 27°C			TCP			Breathing Content		
	F	L	Pos	F	L	Pos	F	L	Pos	F	L	Pos	F	L	Pos	F	L	Pos

**Tap Changer**

PCB	PPM

**Transformer Ratio/Constructor**

Ratio Attached	Yes	No

**Bushing Connections**

Draw	Bobbs	Winding	HPot - KV	Gas Analysis	Per Cent

**Remarks:** WHY AM I HERE - THIS ONE LOOKS GREAT

# Asset Detail – Level 3 第三层 资产细节

Manufacturer: SEIMENS  
Model: G-4567  
Year: 1959

**Station Equipment**

- Wolverine
  - Batteries
  - Capacitor
  - Circuit Breaker
    - CB5095
  - Load Tap Changer
  - Transformer
    - TR1123
    - TR3450
    - TR4085
    - TR5493

**Current Operation**

Wolverine TR3450 \ LTC2001

Load (MWatts): 21.3 Mwatts

LTC Motor: 19.9 Amps (STOP)

Top Oil: 77.3 Deg C

LTC Oil: 89.6 Deg C

Bottom Oil: 60.0 Deg C

Cooling Fans: 18.1 Amps (STAGE 2)

Oil Temperatures (C): [Graph showing multiple temperature lines over time]

**Repair Status**

- Algorithm
  - Differential Oil Temperature
  - Bushing Degradation
- Attention Status
  - Low Nitrogen Pressure
- Good Status
  - Elevated Oil Temperature
  - DGA Alert

URL

Maintenance Overview

Wolverine Substation

Algorithm E-Mail Alerts

**Set History Time**

Start Time: \*-30d

End Time: \*

Apply [Refresh] [Back] [Forward]

**Asset Alert History**

Algorithm	Good	Attention	ack	Repair	ack
Elevated Oil Temperature	100.0%	0.0%		0.0%	
High Temperature Differential	0.0%	0.8%	0.1%	98.8%	0.2%
DGA Alert	100.0%	0.0%		0.0%	
Low Nitrogen Pressure	0.0%	100.0%		0.0%	
Bushing Degradation	0.0%	0.0%		0.0%	100.0%

**Disolved Gas Analysis**

Sample Date	H2	CH4	C2H6	C2H4	C2H2	CO2	CO	O2	N2	TDCG (ppm)	Equiv. TCG (%)	Total Gas (%)	CO2/CO	O2/N2
09/26/90	193	115	137	38	<1	3004	223	2340	22698	813	2	2	13	0
08/01/94	279	185	164	51	<1	4213	341	2627	25482	1140	3	3	12	0
03/06/95	489	399	320	109	<1	1652	315	685	24333	1861	5	2	5	0
03/28/96	1258	1980	590	369	<1	6524	530	732	24800	5227	10	3	12	0

# 使用 ProcessBook 分析

OSI Transmission & Distribution Company > TransDistribuCo > Wolverine\_Asset

TransDistribuCo  
Wolverine Transformer Assets

PI ProcessBook - [http://clewss.osisoft.com/sites/Curt/TransDistribuCo/SVG\_Files/WoverineTR3450.svg]

File Edit View Insert Tools Draw Arrange Window Help

## Wolverine TR3450 \ LTC2001

The interface displays a central diagram of a transformer with the following data points:

- Load (MWatts):** 21.7 Mwatts
- LTC Motor:** 19.3 Amps, **RUN** button
- LTC Position:** (indicated by a green bar)
- Top Oil:** 76.9 Deg C
- LTC Oil:** 93.2 Deg C
- Bottom Oil:** 60.5 Deg C
- Cooling Fans:** 18.8 Amps, **STAGE 1** button
- 19.5 Amps:** **STAGE 2** button

**Oil Temperatures (C) Chart:** Shows three temperature lines (orange, red, green) over a 6-hour period. The y-axis ranges from 30 to 100 degrees Celsius.

**Load (MWatts) Chart:** Shows a fluctuating load line over a 6-hour period. The y-axis ranges from 15 to 25 MWatts.

Server Time: NUM

Minimize  
Close  
Modify Shared Web Part  
Export...  
Help  
Launch in PI ProcessBook  
Ad hoc Trend  
Ad hoc SVG

# 使用 Excel 分析

Station Equipment: Transformer | Current Operation: Station: Wolverine | Repair Status: Algorithm

Microsoft Excel - 817d795c-68db-47b9-be0d-1420ec68ddc9.xml [Read-Only]

File Edit View Insert Format Tools Data Window PI PI-SMT Help

Arial 10 B I U

	A	B	C	D	E	F	G	H	I
1	Date	Hydrogen	Methane	Ethane	Ethylene	Acetelyene	Carbon Dioxide	Carbon Monoxide	Oxygen
2	09/26/90	193	115	137	38	<1	3004	223	2340
3	08/01/94	279	185	164	51	<1	4213	341	2627
4	03/06/95	489	399	320	109	<1	1652	315	685
5	03/28/96	1258	1980	590	369	<1	6524	530	732
6	03/21/98	1390	2568	790	561	<1	5952	554	927

Disolved Gas Analysis

Ready NUM

Disolved Gas Analysis

Date	Hydrogen	Methane	Ethane	Ethylene	Acetelyene	Carbon Dioxide	Carbon Monoxide	Oxygen	Nitrogen	TDCG	Equival TCG
09/26/90	193	115	137	38	<1	3004	223	2340	22698	813	2
08/01/94	279	185	164	51	<1	4213	341	2627	25482	1140	3
03/06/95	489	399	320	109	<1	1652	315	685	24333	1861	5
03/28/96	1258	1980	590	369	<1	6524	530	732	24800	5227	10
03/21/98	1390	2568	790	561	<1	5952	554	927	24651	6	

Save Open

Minimize Close Modify Shared Web Part Export... Help Export to Excel

# Rule Detail (RDB) – Level 4 第四层 规则细节

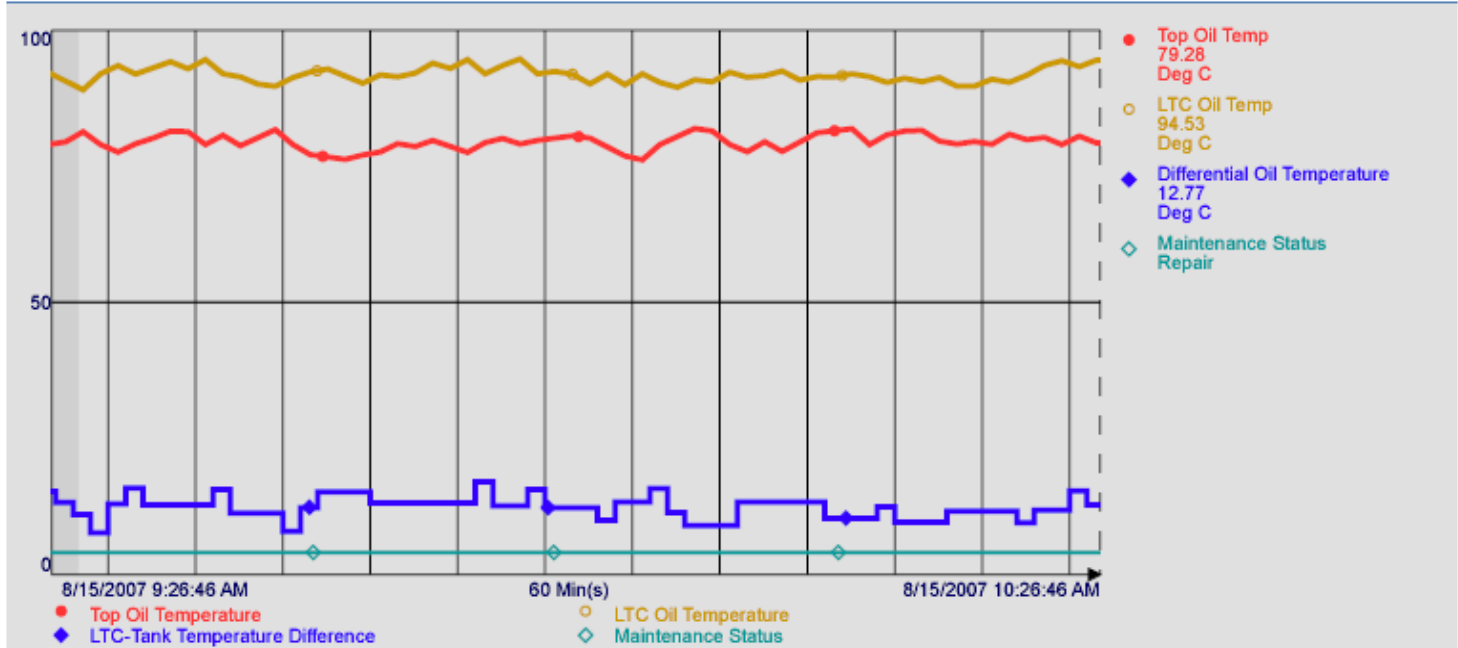
OSI Transmission & Distribution Company > TransDistribuCo > Differential Oil Temperature

TransDistribuCo  
High Differential Oil Temperature

## Asset List

- Transformers
  - TR0606
  - TR0842
  - TR1123
  - TR1171
  - TR2003
  - TR2822
  - TR3045
  - TR3450**
  - TR4085
  - TR4522
  - TR4559
  - TR4967
  - TR5493
  - TR5620
  - TR6002
  - TR6676
  - TR7785
  - TR8243
  - TR9124

## Algorithm Trend



## Set Time Range

Start Time \*-1h

End Time \*

Apply



## Alert Levels

name	value
Attention	5
Repair	7

## Algorithm Values

Descriptor	Average	Units
LTC-Tank Temperature Difference	12.32	Deg C
LTC Oil Temperature	91.81	Deg C
Top Oil Temperature	79.49	Deg C



# Rule Detail (RDB) – Level 4 第四层 规则细节

OSI Transmission & Distribution Company > TransDistribuCo > DGA Alert



TransDistribuCo

## Dissolved Gas Analysis Alert

### Asset List

#### Transformers

- TR0606
- TR0842
- TR1123
- TR1171
- TR2003
- TR2822
- TR3045
- TR3450**
- TR4085
- TR4522
- TR4559
- TR4967

### Attention Levels

name	value
C2H4 Rate	0.3
C2H6 Rate	0.3
CH4 Rate	0.9
CO Rate	0.5
CO2 Rate	0.5
H2 Rate	0.25
N2 Rate	0.5
O2 Rate	0.5

### Repair Levels

name	value
C2H4 Rate	0.5
C2H6 Rate	0.5
CH4 Rate	1.2
CO Rate	0.9
CO2 Rate	0.7
H2 Rate	0.5

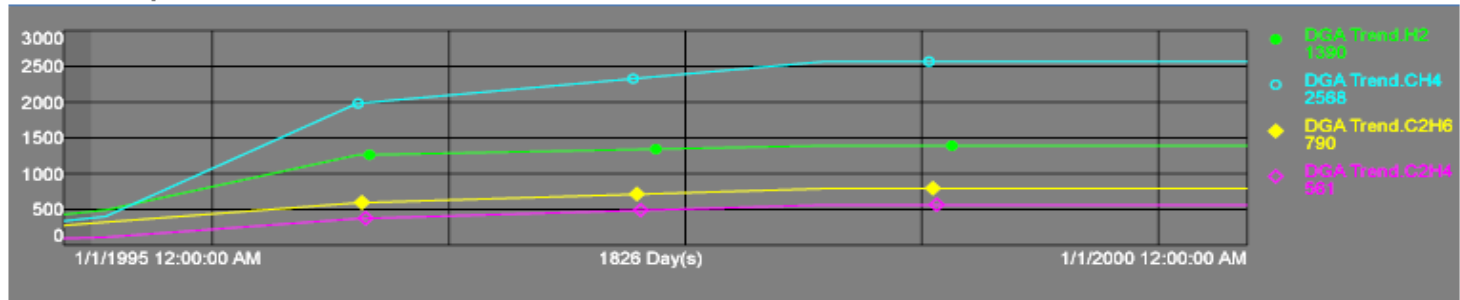
### Dissolved Gas Analysis

Date	Hydrogen	Methane	Ethane	Ethylene	Acetelyene	Carbon Dioxide	Carbon Monoxide	Oxygen	Nitrogen
09/26/90	193	115	137	38	<1	3004	223	2340	22698
08/01/94	279	185	164	51	<1	4213	341	2627	25482
03/06/95	489	399	320	109	<1	1652	315	685	24333
03/28/96	1258	1980	590	369	<1	6524	530	732	24800
03/21/98	1390	2568	790	561	<1	5952	554	927	24651

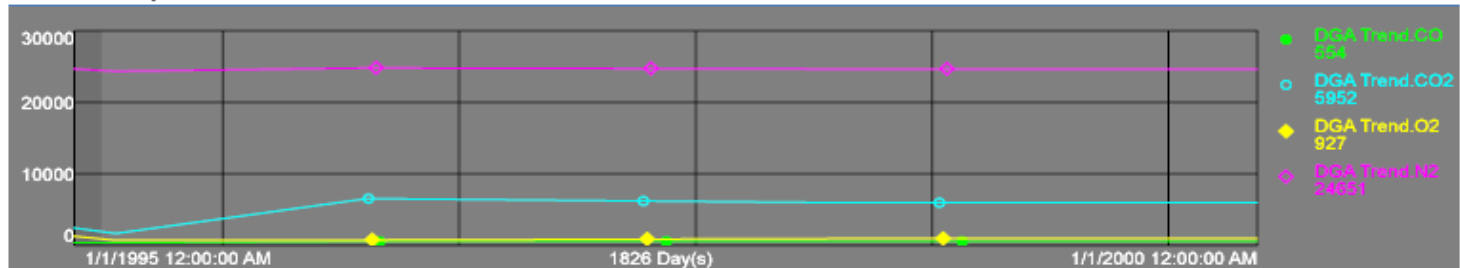
### Latest Change in DGA

Sample Date	Days	H2 Rate	CH4 Rate	C2H6 Rate	C2H4 Rate	CO2 Rate	CO Rate	O2 Rate	N2 Rate
03/21/98	723	0.183	0.813	0.277	0.266	-0.791	3.3E-02	0.27	-0.206

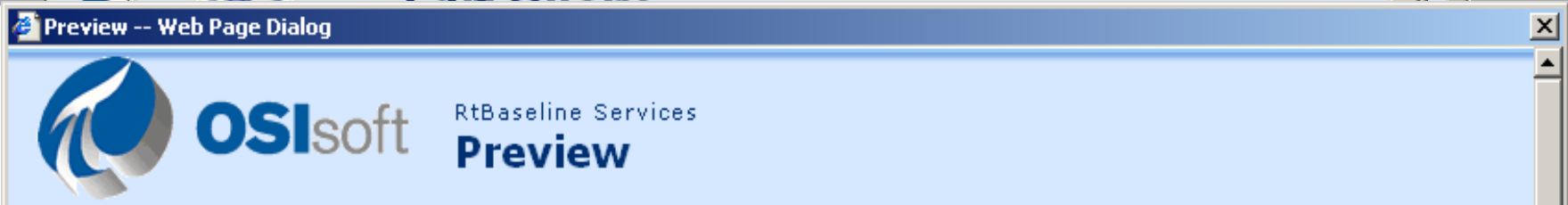
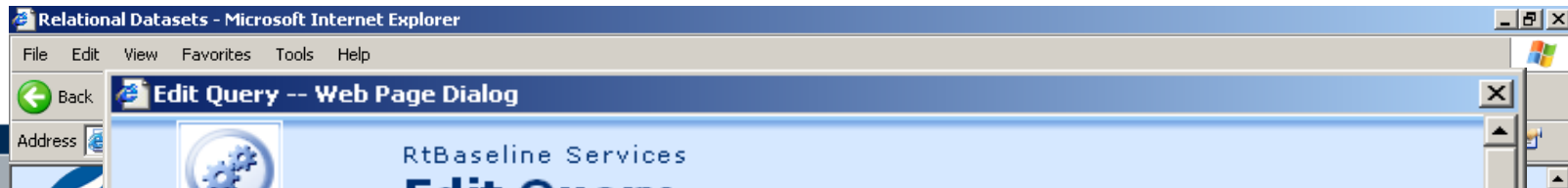
### DGA History H2 - C2H4



### DGA History CO, CO2, O2, N2



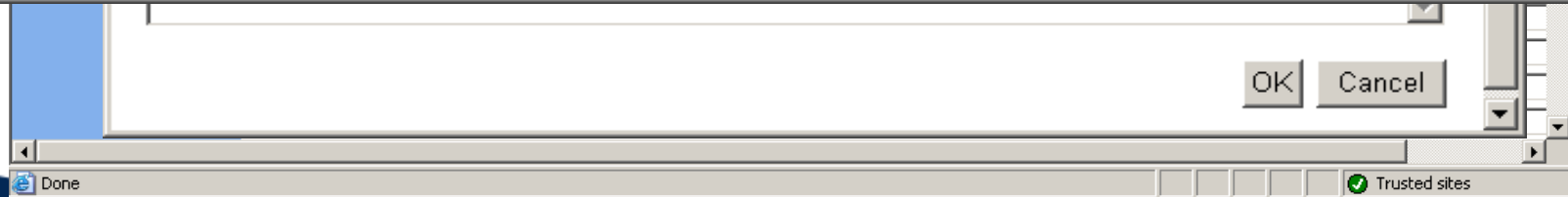
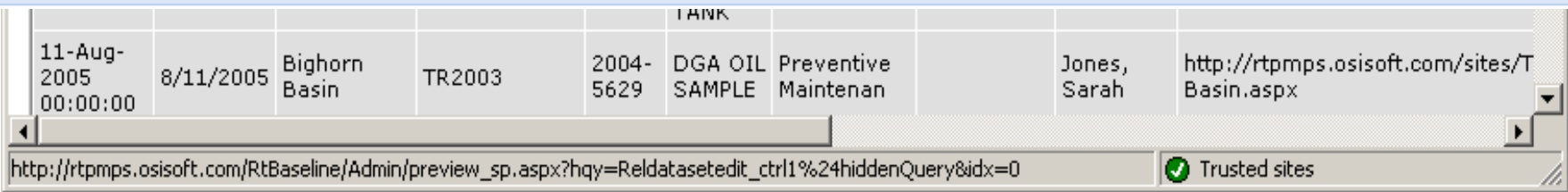
# Access Relational Databases 访问关系数据库



## Recent Workorders

Date	Substation	EquipmentID	Order No	Task	TaskType	Comments	Assigned To
9/5/2005	Victory Valley	CB9376	2004-1194	N2 TANK ADDED	New Installation		Davis, Ron
9/5/2005	Gypsy Junction	TR4522	2003-1034	TCG TEST - MAIN TANK	New Installation	Please pump water	Krupp, Robert
8/11/2005	Bighorn Basin	TR3045	2005-3999	TCG TEST - MAIN TANK	Preventive Maintenanc		Jones, Sarah
8/11/2005	Bighorn Basin	TR2003	2004-5629	DGA OIL SAMPLE	Preventive Maintenanc		Jones, Sarah
8/3/2005	Bighorn Basin	TR2003	2003-1034	TCG TEST - MAIN TANK	Other Maintenance		Davis, Ron

Showing 1 to 5 of 34



# Maintenance Alert Notification 维护告警通知

## Configuration

Name: TR1123 Differential Oil Temperature Repair Alert

Rename

Comment:

Transformer TR1123 has a Differential Oil Temperature "Repair" alert.

Owner: OSTCurt

Change

Status:  Enabled  Disabled

## Alert Trigger

Type:  Limits  Digital

PI Tag: Wfinn\TR1123\_MS\_DT

Digital States: Available States: Alert States:

Attention  
Attention-  
Good  
Repair-Acl  
Reset  
Status 10  
Status 10-

>>

>

<

<<

Repair

Filters: Non-Repetition  Renotification

24 Hours

Alert On Bad Status

## Message Definition

Recipients: curt@osisoft.com

(semicolon delimited)

From: curt@osisoft.com

Importance:  Normal  Low  High

Subject: TR1123 Differential Oil Temperature Repair Alert

Body:  Include pre-defined body

(sample)

```
\\piserver1\TC107 High Limit exceeded. Current value: 702.16 deg F  
at 27-Jun-2002 10:51 AM. High Limit 700.00 deg F
```

Postscript:

[http://shareberry.osisoft.com/sites/Curt/TransDistribuCo/Differential%20Oil%20Temperature\\_TR1123.aspx](http://shareberry.osisoft.com/sites/Curt/TransDistribuCo/Differential%20Oil%20Temperature_TR1123.aspx)

# Notification Email with URL

The screenshot shows an Outlook window titled "RtAlert: Unit 1 Waterflow Violation - Message (HTML)". The interface includes a ribbon with "Message" and "Report Rendering Problem" tabs, and a ribbon menu with sections for Respond, Actions, Junk E-mail, Options, Find, and OneNote. The email content is displayed below the ribbon, featuring a yellow "Follow up." bar and a red "Red Category" bar. The email header shows the sender as Gregg Le Blanc, sent on Mon 9/11/2006 6:48 PM. The subject is "RtAlert: Unit 1 Waterflow Violation". The body text states: "A violation has been detected on **UNIT 1** at **09/05/2006 12:00 PM**. **Waterflow** has dropped **below** desired levels. To investigate this further, please browse to the following link: [http://rtmpms.osisoft.com/sites/UC2006/Shared%20Documents/Unit%20Detail.aspx?RtTreeView\\_SelectedNodeTag=\\RTPMPI\OSIHyc](http://rtmpms.osisoft.com/sites/UC2006/Shared%20Documents/Unit%20Detail.aspx?RtTreeView_SelectedNodeTag=\\RTPMPI\OSIHyc)".

RtAlert: Unit 1 Waterflow Violation - Message (HTML)

Message Report Rendering Problem

Reply Reply to All Forward Call

Delete Move to Folder Create Rule Other Actions

Block Sender Not Junk Safe Lists

Categorize Follow Up Mark as Unread

Find Select

Send to OneNote OneNote

Follow up.

Red Category

From: Gregg Le Blanc Sent: Mon 9/11/2006 6:48 PM

To: Gregg Le Blanc

Cc:

Subject: RtAlert: Unit 1 Waterflow Violation

A violation has been detected on **UNIT 1** at **09/05/2006 12:00 PM**  
**Waterflow** has dropped **below** desired levels.  
To investigate this further, please browse to the following link:  
[http://rtmpms.osisoft.com/sites/UC2006/Shared%20Documents/Unit%20Detail.aspx?RtTreeView\\_SelectedNodeTag=\\RTPMPI\OSIHyc](http://rtmpms.osisoft.com/sites/UC2006/Shared%20Documents/Unit%20Detail.aspx?RtTreeView_SelectedNodeTag=\\RTPMPI\OSIHyc)

# Asset Reliability Report 资产概要报表

 TransDistribuCo - Asset Maintenance Report

Reporting Period: 12/05/05 04:04 PM through 02/03/06 04:04 PM

Asset ID: TR3450

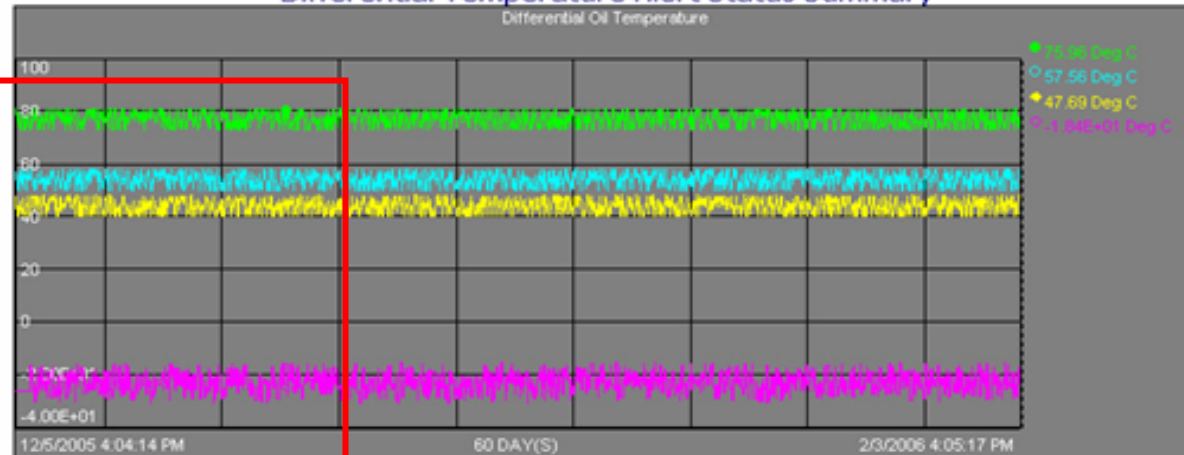
Substation: Wolverine

Serial No. Manufacturer Year Model MVA Rating kV Rating Fluid Capacity  
 X9945 SEIMENS 1959 G-4567 50 120 3440

### Maintenance Algorithm Status Summary

Time in Hours	Good	Attention	Attention (ACK)	Repair	Repair (ACK)
Asset Status		31 <sup>1</sup>	73	953	103
Differential Oil Temperature	0	2			
Elevated Oil	1440				

### Differential Temperature Alert Status Summary



### Work Orders

Date	Work Order No	Task	Tas
7/11/2005	2004-1120	DOBLE TEST - MX	Preventive
7/7/2005	2003-1034	N2 TANK ADDED	Preventive
7/7/2005	2005-3999	DGA OIL SAMPLE	New Install
7/3/2005	2004-4926	DOBLE TEST - MX	Preventive
7/3/2005	2004-5629	TCG TEST - MAIN TANK	Other Main
7/2/2005	2003-1034	TCG TEST - MAIN TANK	New Install
6/2/2005	2003-1034	TCG TEST - MAIN TANK	Preventive
4/13/2005	2002-1234	N2 SYSTEM REPAIR	Other Main
4/13/2005	2002-1234	DOBLE TEST - MX	Other Main
3/5/2005	2003-1034	NEW SETUP MAIN TANK	Other Main
3/3/2005	2003-1034	N2 SYSTEM REPAIR	Other Main
3/3/2005	2002-1234	TCG TEST - MAIN TANK	New Install
3/3/2005	2004-5629	OIL QUALITY SAMPLE	Other Main
2/5/2005	2004-5629	OIL LEAK - INSPECTION	Other Main
2/5/2005	2005-3999	OIL QUALITY SAMPLE	Preventive
2/2/2005	2004-1120	N2 CYL REPLACEMENT	Other Main
1/16/2005	2004-1194	OIL QUALITY SAMPLE	New Install

Algorithm Input	Average	Maximum	Minimum
Top Oil Temperature	78.26	82.00 22-Jan-06 00:01	74.00 25-Dec-05 12:07
LTC Oil Temperature	91.22	95.00 24-Dec-05 01:07	87.00 30-Jan-06 21:16
Bottom Oil Temperature	62.13	66.00 11-Jan-06 18:07	58.00 18-Jan-06 09:27
Tank-LTC Temperature Difference	12.93	20.61 22-Dec-05 11:37	5.14 18-Jan-06 16:27

# Office 2007 Excel Services with DataLink

**RtTimeRange**

Start Time  
4/2/2007 12:00:00 AM

End Time  
4/3/2007 12:00:00 AM

Apply

**Excel Web Access - Transformer Report**

Open | Update | Find

<i>Transformer Performance Report</i>							
3	Date	April 3, 2007					
4	Asset	TR3045					
5	Station	Bighorn Basin					
				Averages		<---7 Day Range --->	
				1 Hour	1 Day	Minimum	
7	Load	21.2	Mwatts	21.1	21.4	3/29/07 16:02	19.9
9	Top Oil Temperature	75.7	Deg F	77.1	77.0	3/31/07 2:16	74.0
10	Bottom Oil Temperature	62.9	Deg F	64.2	64.1	3/27/07 4:57	61.0
12	LTC Motor Current	19.5	Amps	19.7	19.7	3/30/07 16:34	18.7
13	LTC Motor Status	RUN					
15	Cooling Fan Current	20.7	Amps	20.3	20.4	3/27/07 5:48	19.4
16	Cooling Fan Status	STAGE 1					

**RtTreeView**

Transformers

- TR0606
- TR0842
- TR1123
- TR1171
- TR2003
- TR2822
- TR3045
- TR3450
- TR4085
- TR4522
- TR4559
- TR4967
- TR5493
- TR5620
- TR6002
- TR6676
- TR7785
- TR8243
- TR9124
- TR9946

**LTC Motor Use**

0%



100%

- STOP
- RUN

**Cooling Fan Use**



- OFF
- STAGE 1
- STAGE 2

# Office 2007 Excel Services with DataLink

**RtTimeRange**

Start Time  
4/2/2007 12:00:00 AM

End Time  
4/3/2007 12:00:00 AM

Apply [Refresh] [Previous] [Next]

**Excel Web Access - Transformer Report**

Open | Update | Find

<i>Transformer Performance Report</i>							
3	Date	April 3, 2007					
4	Asset	TR1123					
5	Station	Wolverine					
				Averages		<--7 Day Range -->	
				1 Hour	1 Day	Minimum	
7	Load	19.9	Mwatts	21.1	21.0	3/28/07 22:55	19.5
9	Top Oil Temperature	77.9	Deg F	77.9	78.0	4/1/07 16:09	75.0
10	Bottom Oil Temperature	45.6	Deg F	45.3	45.0	3/28/07 11:10	42.0
12	LTC Motor Current	19.6	Amps	19.8	19.8	3/29/07 14:54	18.8
13	LTC Motor Status	RUN					
15	Cooling Fan Current	19.5	Amps	20.0	20.0	3/27/07 19:43	19.0
16	Cooling Fan Status	OFF					

**RtTreeView**

Transformers

- TR0606
- TR0842
- TR1123
- TR1171
- TR2003
- TR2822
- TR3045
- TR3450
- TR4085
- TR4522
- TR4559
- TR4967
- TR5493
- TR5620
- TR6002
- TR6676
- TR7785
- TR8243
- TR9124
- TR9946

**LTC Motor Use**

0%

100%

- STOP
- RUN

**Cooling Fan Use**

- OFF
- STAGE 1
- STAGE 2

# Office 2007 Excel Services with DataLink

**RtTimeRange**

Start Time  
3/27/2007 12:00:00 AM

End Time  
3/28/2007 12:00:00 AM

Apply [Refresh] [Previous] [Next]

**Excel Web Access - Transformer Report**

Open | Update | Find

## Transformer Performance Report

**Date** March 28, 2007

**Asset** TR1123

**Station** Wolverine

	Averages		<...7 Day Range ...>	
	1 Hour	1 Day	Minimum	
<b>Load</b>	21.7 Mwatts	21.2 21.0	3/22/07 11:21	19.5
<b>Top Oil Temperature</b>	77.6 Deg F	78.2 77.9	3/21/07 21:24	75.0
<b>Bottom Oil Temperature</b>	45.5 Deg F	45.2 44.9	3/22/07 23:05	42.0
<b>LTC Motor Current</b>	20.3 Amps	19.7 19.8	3/26/07 11:09	18.8
<b>LTC Motor Status</b>	<b>RUN</b>			
<b>Cooling Fan Current</b>	20.5 Amps	20.1 20.0	3/26/07 6:53	19.0
<b>Cooling Fan Status</b>	<b>STAGE 1</b>			

**RtTreeView**

Transformers

- TR0606
- TR0842
- TR1123**
- TR1171
- TR2003
- TR2822
- TR3045
- TR3450
- TR4085
- TR4522
- TR4559
- TR4967
- TR5493
- TR5620
- TR6002
- TR6676
- TR7785
- TR8243
- TR9124
- TR9946

**LTC Motor Use**

0%

100%

- STOP
- RUN

**Cooling Fan Use**

- OFF
- STAGE 1
- STAGE 2



# 结语

- 凭借你的现有的投资和资源, 更加利用 **PI**系统, 以为你们的单位组织, 提供更多的价值
- 进一步扩大效益, 由操作运行, 到工程, 计划, 保护, 维修和资产管理

谢谢 !!