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# USERS CONFERENCE 2016

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# Asset Maintenance and Condition Assessment at PSEG

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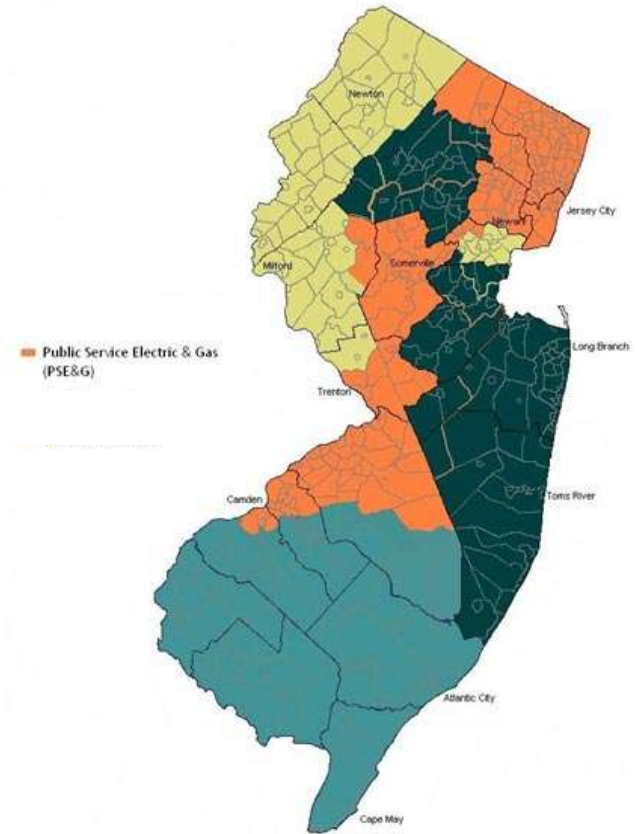
# Agenda

- About PSEG
- CMMS
  - Current Analytics
  - Benefits
- Energy Strong
- PSEG Project Management
- Accenture Technical Design and Delivery
- Future ES Analytics
- Conclusion

# Asset Maintenance And Condition Assessment

# About PSEG

- New Jersey Based
- Total Assets ~ \$17 Billion
- Total Revenue ~ \$8 Billion
- Service Territory 323 Municipalities
- 70% of New Jersey's population
- 2.2 million Electric customers
- 1.8 million Gas customers
- 2,600 Square Miles
- 22,223 Distribution Circuit Miles
- 1,735 Transmission Circuit Miles



# What is CMMS?

- CMMS is a decision support system that assists in making repair and replace maintenance decisions for:
  - Transformers
  - Load Tap Changers
  - Breakers & Circuit Switchers
  - Transmission OH and UG Assets
  - 26 KV UG Transformers & Protectors

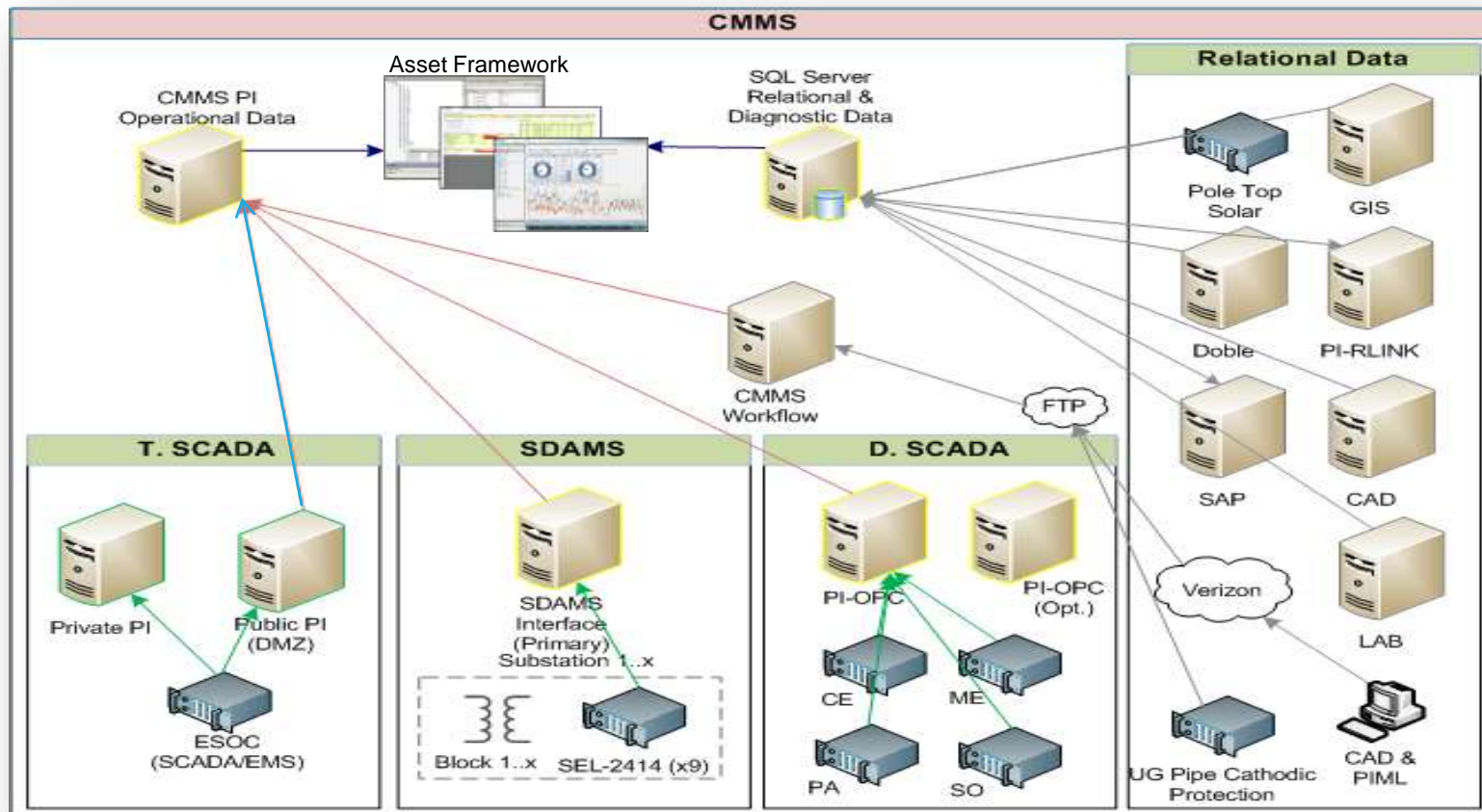


# CMMS Vision

- To perform the right maintenance at the right time, based on the *consistent* analysis of data to ensure a safe, reliable & cost effective approach
- Centralize and correlate operational, diagnostic, real-time sensor data, order history and asset characteristics down to asset level
- Create action and replacement algorithms based on asset condition that turn data into actionable information.
- Use data to drive business plans for asset replacement

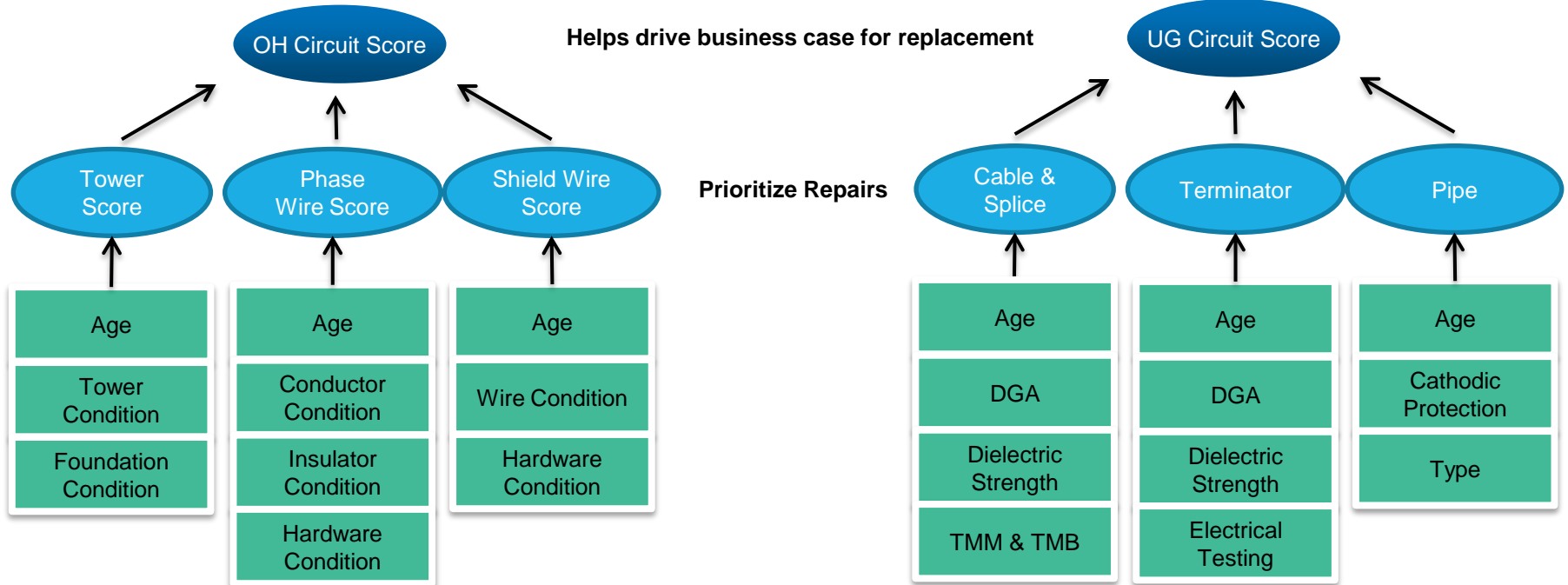


# Data Collection





# Condition Based Maintenance & Reliability - Transmission OH and UG



# Condition Based Maintenance & Reliability - Substation Assets

## Transformers

### Action Algorithm

Detectable Acetylene

Moisture

Dielectric Strength

Cooling Performance

### Replacement Algorithm

Chronological Age

Action Score

Corrective Maintenance

Spare Availability

Loss of Life Aging Factor

## Breakers/Circuit Switchers

### Action Algorithm

Age

Operated in 6 months?

Operated in 12 months?

### Replacement Algorithm

Electrical Testing

Age

Corrective Maintenance

SF6 Leaks

# Condition Based Maintenance & Reliability - Distribution Overhead Circuits

## Poorest Performing Circuits (PPC)

Extended Customers Interrupted
Total CMI
Voltage Class
PPC History

## Vegetation Management

# of Customers & # of Hospitals on circuit
Total CMI
VM Cost History
Voltage Class & Circuit Mileage

- Program: Provide guidance on what to trim or remediate within the given budget to optimize SAIFI reductions

# Correlate Data to Asset

The screenshot displays the PI System Explorer interface. On the left, a tree view shows the hierarchy of elements under 'PIE'. The 'T1' element is expanded, showing a list of assets including '00000000010503779 Circuit Switcher' and '00000000010503783 Power Transformer'. The 'Power Transformer' asset is selected, and its details are shown in the right-hand pane.

The right-hand pane shows the 'General' tab for the '00000000010503783 Power Transformer' asset. It displays a table of attributes and their values:

Name	Value
FLOC NUMBER	PIE-CE-ADA-T1
GAL-1000	12.40
INST-COST	0.30
INSTALL DATE	1967/01/01
INSTR-BOOK	114
INSUL-SYSTEM	15.00
LDAD-LOSS-KW	107.70
MANUFACTURER	WESTINGHOUSE
MAX WINDING #1 TEMP.	60
MODEL NUMBER	URT
MV90 KVAR (IN)	0
MV90 KVAR (OUT)	0
MV90 KW	5040
MV90 VDLTS	70.184
MVA	-0.350624
MVAR	-0.52059
MW	22.93186
NITROGEN CYLINDER P.	500
NITROGEN PRESSURE	2
NL-LOSS-KW	33.50
OIL-GALLONS	12000.00
OPER-KV	230-13
P1-NCP	Active
P1-NP	Ph Created
P1-OL	Ph Created

# Transformer CA-Action Summary

 Filter by Substation

 Filter by Voltage

## Action Results

Details	Station Name	Division	Flac	Flac Descr	Equipment	Equip Descr	Score	# of Person	Status	Voltage	Manufacturer	Serial Number
	CORSETTS	CE	PE-CE-CORB-8114	Mobile M-14 (SPARE 83MVA)	00000000010780221	Transformer (M-14) - 83MVA	10	Lenny/Paul	Pastor Management Issue	230-25	EPAGEC	C0857A
	ACADEMY STREET	PA	PE-PA-ACA-T1	# 1 Transformer	00000000010514858	Power Transformer	8.10		Continue to monitor	25-4	PENNSYLVANIA	403952
	FURINO & SONS, INC	CE	PE-CE-FURI	FURINO	00000000010608238	Power Transformer FAILED AT HYUNDAI	7.78	George	Vendor Repair	230-53	HYUNDAI	301125811F00
	HINCHMANS	ME	PE-ME-HNC-T2	# 2 Transformer	00000000010607170	Power Transformer	8.3	George	Continue to monitor	230-53	FEDERAL PACIFIC	802541
	FAIRLAWN SW	ME	PE-ME-SFL-4TRH	220-1 Transformer	00000000010810108	Power Transformer	8.83	Paul Morakinyo	Continue to Monitor	230-53B	GENERAL ELECTRIC	M101694
	METUCHEN SWITCH	CE	PE-CE-SMN-SPARE	Spare Equipment	00000000010019481	Voltage Regulator 280V Spare	8.74	John Wilson	Continue to Monitor	25	MOLONEY	P670034
	ORANGE VALLEY	ME	PE-ME-ORA-T4	# 4 Transformer	00000000010608818	Power Transformer	8.74	Don Falkor	Being Monitored	25-4	PENNSYLVANIA	356432
	GETTY AVE	ME	PE-ME-GET-T1	# 1 Transformer	00000000010609982	Power Transformer	8.74	George	OK	25-4	ALLIS CHALMERS	3079830
	MARION SWITCH	PA	PE-PA-SMA-3TR	132-3	00000000010023083	Power Transformer 132-3C	8.85	John Wilson	Retire	130-25-11	WESTINGHOUSE	8038736
	KEASBEY	CE	PE-CE-KEA-T3	# 3 Transformer	00000000010801808	Power Transformer	8.37	Paul Morakinyo	Monitor	25-4	MOLONEY	849893
	ORANGE VALLEY	ME	PE-ME-ORA-T2	# 2 Transformer	00000000010608813	Power Transformer	8.37	George	Pending Action	25-4	PENNSYLVANIA	356431
	VAUGHN HALL ROAD	CE	PE-CE-VHL-T3	# 3 Transformer	00000000010803610	Power Transformer T3	8.37	John Wilson	No Action	25-4	ALLIS CHALMERS	3837523
	BLOOMFIELD	ME	PE-ME-BLO-T1	# 1 Transformer	00000000010609094	Power Transformer	8.20	George	Continue to Monitor	25-4	GENERAL ELECTRIC	M1514900
	FEDERAL SQUARE SUBSTATION	ME	PE-ME-FSD-T1A	Transformer T1A	00000000010748217	Power Transformer	8.10			25-4	GE PROLEC	Q1488-05
	LAKESIDE	ME	PE-ME-LAS-T3	# 3 Transformer	00000000010807634	Power Transformer	8.10	George	Request OSA Sample	25-4	ALLIS CHALMERS	2749600
	CALDWELL	ME	PE-ME-CAD-T2	# 2 Transformer	00000000010608116	Power Transformer	8.10	Don Falkor	Being Monitored	25-4	ALLIS CHALMERS	3569103
	PASSAIC	ME	PE-ME-PAS-T2	# 2 Transformer	00000000010808748	Power Transformer B	8	George Arthur	OK	25-4	ALLIS CHALMERS	3020337
	MORGAN STREET	PA	PE-PA-MOO-T1	# 1 Transformer	00000000010516358	Power Transformer	8			25-4	GENERAL ELECTRIC	05H15840
	BRUNSWICK SWITCH	CE	PE-CE-SBR-3TRH	220-3 Transformer	00000000010800123	Voltage Regulator 220-3 280V	8	George	OK	25	MOLONEY	P670033
	BRUNSWICK SWITCH	CE	PE-CE-SBR-1TRH	220-2 Transformer	00000000010800124	Voltage Regulator 220-2 280V	8	Paul	Replacement	25	MOLONEY	P670032
	UNION	CE	PE-CE-UN-T1	# 1 Transformer	00000000010603527	Power Transformer T1	8	Mark	Follow-up	25-4	ALLIS CHALMERS	3083107
	UNION	CE	PE-CE-UN-T2	# 2 Transformer	00000000010603528	Power Transformer T2	8	Mark	OK	25-4	ALLIS CHALMERS	3083106
	BLOOMFIELD	ME	PE-ME-BLO-T2	# 2 Transformer	00000000010609092	Power Transformer	8	George Arthur	No Action	25-4	GENERAL ELECTRIC	M1514900
	RODGWOOD	PA	PE-PA-RGW-T2	# 2 Transformer	00000000010516814	Power Transformer	8			25-4	ALLIS CHALMERS	2414121
	PRINCETON	SO	PE-SO-PRN-T1	# 1 Transformer	00000000010620682	Power Transformer	8			25-4	ALLIS CHALMERS	3182938
	ATHENA SW	ME	PE-ME-SAY-132-3	132-3 Transformer	00000000010609407	Power Transformer Phase 1	8	Paul Morakinyo	Continue to monitor	130-25-11	GENERAL ELECTRIC	M102359
	ALLWOOD	ME	PE-ME-ALL-T2	# 2 Transformer	00000000010608878	Power Transformer	4.81			25-4	ALLIS CHALMERS	3182891
	CENTRAL AVE	ME	PE-ME-CET-T2	# 2 Transformer	00000000010603068	Power Transformer	4.81			25-4	VIRGINIA TRANSFORMER	45000A004-0
	HASBROUCK HEIGHTS	PA	PE-PA-HBS-LWHT1	300A	00000000010515588	LVH Transformer	4.81	Paul	OK	25-13	MCGRAW EDISON	05441181
	BELLEVILLE	ME	PE-ME-BEE-T1	# 1 Transformer	00000000010609626	Power Transformer	4.81	John Wilson	Awaiting Markt.	25-4	ALLIS CHALMERS	3181227
	GETTY AVE	ME	PE-ME-GET-T2	# 2 Transformer	00000000010609983	Power Transformer	4.81			25-4	ALLIS CHALMERS	3079831
	CAFFERTY	CE	PE-CE-CAT-T2	# 2 Transformer	00000000010800879	Power Transformer 2A	4.83	NA	DLPF Order	25-4	ALLIS CHALMERS	1798882
	GREENVILLE	PA	PE-PA-GRN-T3	# 3 Transformer	00000000010603084	Power Transformer A	4.83			25-4	WESTINGHOUSE	1215501
	FINDERNE	CE	PE-CE-FIN-T2	# 2 Transformer	00000000010604084	Power Transformer	4.83			25-4	ALLIS CHALMERS	1788881

## Transformer Action Details

### Equipment Nameplate

Division	Station Code	Station	Station Type	File Descr	Equipment	Equipment Descr	Equipment Type	Construction Year	Serial Number	Manufacturer	Model Number
Mesa	SFL	FAIRLAWN SW 3		220-1 Transformer	00000000010E10100	Power Transformer	E-TRF-TRF		1400 M101004	GENERAL ELECTRIC	LRT 500

### Other Links

- Equipment Home Page
- View and Trend Equipment R Points
- SAP Order Details
- CA Comment History
- CA Transformer Action Algorithm Rules

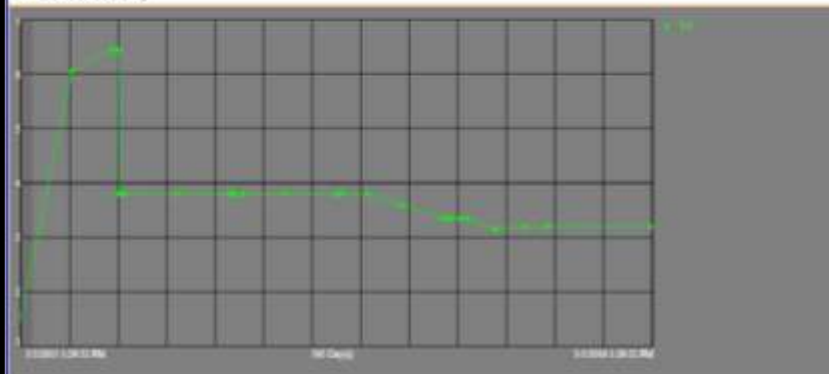
### Algorithm Factors by Peer Group

Factor	Raw Value	Case Value	Weight %	Score
Detective Acetylene	0	0	25	2.0
Gas Rate of Change	-0.240	0	10	0
High Total Gas	1.990	1	20	0.2
Low Detectio	31.1	0	10	3.0
Top Oil Temperature		0	40	0
Water Content	0	0	20	0

### CA Score

File Number	Score	maxScore	Ranking(%)	Peer Group	Algorithm	Algorithm Group
PEL40-SFL-470H	0.2	5.4	62.26	230-344H	CA TRF GE 220KV - ACTION_2012	Transformer_Action_2012

### CA Score History



### DGA Tests

Details	ApprType	Sample Date	CO H2	Acetylene	Ethane	Ethylene	Methane	Combustible Gas	Water
TRN		01/04/2010	030.40	0	03	104	210	1100	0
TRN		11/12/2010	034.40	7	00	200	210	1170	0
TRN		09/02/2010	020.33	4	00	140	211	1120	10
TRN		09/05/2010	007.20	7	00	100	104	1070	0
TRN		03/20/2010	040.40	0	40	100	104	1100	4
TRN		12/01/2010	000.10	0	01	100	200	1120	0
TRN		08/09/2010	000.30	0	00	170	102	1000	10
TRN		00/14/2010	000.41	0	04	100	100	1120	0
TRN		00/00/2010	071.40	0	00	170	100	1120	0
TRN		04/24/2010	700.00	0	40	170	100	1170	0
TRN		01/01/2010	007.00	0	40	100	100	1000	0
TRN		01/01/2010	000.00	0	47	170	170	1110	0
TRN		01/17/2010	024.40	7	47	170	171	1000	7
TRN		12/12/2010	024.00	0	40	100	100	1040	0
TRN		12/09/2010	044.07	0	42	100	100	000	0
TRN		00/10/2010	004.40	4	40	100	100	1000	10
TRN		00/14/2010	001.00	0	41	100	100	1070	10
TRN		00/13/2010	040.04	0	31	124	120	070	7
TRN		11/07/2010	040.07	0	00	120	124	007	0
TRN		09/24/2010	040.01	0	31	121	120	074	7

Showing 1 to 20 of 7

### Fluid Tests

Details	ApprType	Sample Date	Fluid Temp (C)	D877	D1010
TRN		09/02/2010	40		31.1
TRN		07/04/2011			32.0
TRN		01/10/2010			01.4
TRN		11/13/2009			
TRN		11/12/2009	20		40.0
TRN		09/09/2009	20		32.0
TRN		02/01/2008			07
TRN		12/12/2006			04.0
TRN		10/26/2005			07.1

## DeltaX Fluid Test Results

Equipment	Designation	ApprType	Sample Date	Fluid Condition	IFT	D1816	D877	PF25	PF100	Water	Comment	Reason
403962	No. 1	TRN	06/18/2014	2	23.4	28.6	0.158			38	LT 40	ROUTINE
403962	No. 1	TRN	04/26/2013	2	22.1	27.8	0.186			27	LT 30	ROUTINE
403962	No. 1	TRN	03/25/2013	2	22.5	30.3	0.115			17	LT 20	ROUTINE
403962	No. 1	TRN	03/22/2012	2	23.6	39.8	0.123			24	LT 38	ROUTINE
403962	No. 1	TRN	05/10/2011	2	21.4	26.6	0.141			37	LT 30	ROUTINE
403962	No. 1	TRN	03/09/2010	1	25.7	38.8	0.115			20	LT 39	ROUTINE
403962	No. 1	TRN	03/04/2009	2	23.3	45.4	0.14			14	LT 35	ROUTINE
403962	No. 1	TRN	02/27/2008	2	22.8	44.3	0.125			14	LT 25	ROUTINE
403962	No. 1	TRN	03/27/2007	2	21.6	41.5	0.107			21	LT 25	ROUTINE
403962	No. 1	TRN	04/11/2006	1	24.1	33.5	0.12			20	LT 30	ROUTINE
403962	No. 1	TRN	04/05/2005	2	22.5	30.1	0.122			17	LT 22	ROUTINE
403962	No. 1	TRN	04/16/2003	2	22.8	29.6	0.105			28	LT 40 ; PCB < 50 TK CBD	ROUTINE
403962	No. 1	TRN	04/11/2002	2	23.4	31.5	0.092			25	LT 35	ROUTINE
403962	No. 1	TRN	06/11/2001	2	25.3	32.7	0.11			39	LT=30	ROUTINE
403962	No. 1	TRN	05/17/2001	1	24.6	30.7	0.097			30		ROUTINE
403962	No. 1	TRN	05/13/2000	1	25.6	30.3	0.102			28	TEMP=30C	ROUTINE
403962	No. 1	TRN	04/06/1999	1	26.4	32.2	0.121			16		ROUTINE
403962	No. 1	TRN	09/02/1998	2	23.8	15.1	0.093			39		ROUTINE
403962	No. 1	TRN	08/27/1998	2	25.8	16.1	0.1			52	TEMP=50C	ROUTINE
403962	No. 1	TRN	03/04/1997	1	26.1	34.9	0.086			16		ROUTINE
403962	No. 1	TRN	06/12/1996	2	23.1	15.9	0.091			43		ROUTINE
403962	No. 1	TRN	07/03/1995	2	22	20	0.094					
403962	No. 1	TRN	06/30/1995	2	21	13	0.1					
403962	No. 1	TRN	05/23/1995	2	20	18	0.098					



# Equipment Order History

## Time Range

Start Time  End Time

## Nameplate

Online	Division	Station Code	Station	Station Type	Floc Descr	Equipment	Equipment Descr	Equipment Type	Construction Year	Serial Number	Manufacturer	Model Number
	Southern	SNF	NEW FREEDOM X		500-2 Transformer	000000000010523975	Power Transformer 500-2B	E-TRF-TRF		1970 D596878	GENERAL ELECTRIC	LRS 700

## PM Teco Orders

Order	Order Description	Priority	Work Center	Status	Planned Cost	Actual Cost	Completion Date
000100834035	Southern TFMR 230kV-500kV 1yr 1		SO-ME	TECO	2894.7	241.28	5/20/2014 12:00:00 AM
000100736713	Southern TFMR 230kV-500kV 1yr 1		SO-ME	CLSD	1392.5	611.27	2/10/2013 12:00:00 AM
000100767593	DGA Sample	C	SO-ME	CLSD	0	107.55	11/23/2012 12:00:00 AM
000100748889	DGA Resample	C	SO-ME	CLSD	0	165.1	7/30/2012 12:00:00 AM
000100679524	Southern TFMR 230kV-500kV 1yr 1		SO-ME	CLSD	4292.5	336.91	4/28/2012 12:00:00 AM
000100614164	So. Transf.-230kv -500KV2yr 1		SO-ME	CLSD	1320.8	84.22	4/28/2012 12:00:00 AM
000100614428	Southern TFMR 230kV-500kV 1yr 1		SO-ME	CLSD	4032.1	1130.8	5/8/2011 12:00:00 AM

## PM Teco Order Operations

Operation	Description	Planned Hours	Actual Hours	Sub-Operation
0010	TRF (ALL) Desicant System - Transm 1yr	1	0.5	0000
0020	TRF (ALL) Cooling System - Transm 1 yr	16	0.5	0000
0030	TRF (ALL) Gas in Oil Test - Transm 1yr	1	0.5	0000
0060	MTS-Transf. ( ALL ) 1 Yr. Oil Test	0	0	0000

## PM Open Orders

Order	Order Description	Priority	Work Center	Status	Planned Cost	Actual Cost	Due Date
000100902409	Transformers 69KV-500KV Transm 4yr 1		SO-ME	OPEN	0	0	7/1/2016 12:00:00 AM
000100851772	Southern TFMR 1230V-500kV 1yr	1	SO-ME	OPEN	3123.9	0	5/20/2015 12:00:00 AM

## PM Open Order Operations

Operation	Description	Planned Hours	Actual Hours	Sub-Operation
0010	69KV-500KV Phys Oil Test - Transm 4yr	6	0	0000
0020	MTS-Physical Oil Test - Transm 4yr	0	0	0000

## Maintenance Cycles

Last_Comp_Date	Next_Sched_Date	Maint_Cycle
2009-03-18	2019-03-18	10
2013-12-12	2017-12-12	4
2012-04-28	2014-04-28	2
2010-03-09	2014-03-09	4
2010-03-09	2012-03-09	2

## PM Actual Cost

Total PM Cost
2677.1

## PM Actual Hours

Total PM Hours
12.3

## CM Actual Cost

Total CM Cost
8253.7

## CM/PM Ratio

Total PM Cost	Total CM Cost	CM-PM Ratio
2677.1	8253.7	3.08

# Equipment PI Points

## Nameplate

Division	Station Code	Station	Station Type	Floc Descr	Equipment	Equipment Descr	Equipment Type	Construction Year	Serial Number	Manufacturer	Model Number
Southern	SNF	NEW FREEDOM X		# 2 Phase Angle Regulator (W-2223)	00000000010523999	Phase Angle Regulator 2 Exciter	E-TRF-PAR		1973 K546937	GENERAL ELECTRIC	2 X LR400G

## Max Value

Time	Max
3/16/2015 9:26:46 PM	1461.

## Min Value

Time	Min
2/20/2015 3:40:18 PM	1400.

## Average Value

Time	Average
4/20/2015 8:54:54 AM	1440.84

## Standard Deviation

Time	Standard Deviation
4/20/2015 8:54:54 AM	8.49

## Archive Values

Time	Status	Value
4/18/2015 11:19:02 AM	Good	1443.
4/18/2015 10:40:10 AM	Good	1443.
4/18/2015 10:39:29 AM	Good	1443.
4/18/2015 10:39:29 AM	Good	1443.
4/18/2015 10:32:15 AM	Good	1443.
4/18/2015 10:29:49 AM	Good	1443.
4/18/2015 10:08:25 AM	Good	1443.
4/18/2015 10:08:25 AM	Good	1443.
4/15/2015 10:48:05 AM	Good	1443.
4/15/2015 10:45:06 AM	Good	1443.
4/15/2015 9:03:44 AM	Good	1443.
4/15/2015 9:03:44 AM	Good	1443.
4/15/2015 8:58:11 AM	Good	1444.
4/15/2015 8:46:36 AM	Good	1443.
4/15/2015 8:46:36 AM	Good	1443.
4/15/2015 8:23:09 AM	Good	1443.
4/8/2015 12:44:42 PM	Good	1443.
3/31/2015 10:33:35 AM	Good	1443.
3/28/2015 6:41:25 AM	Good	1446.

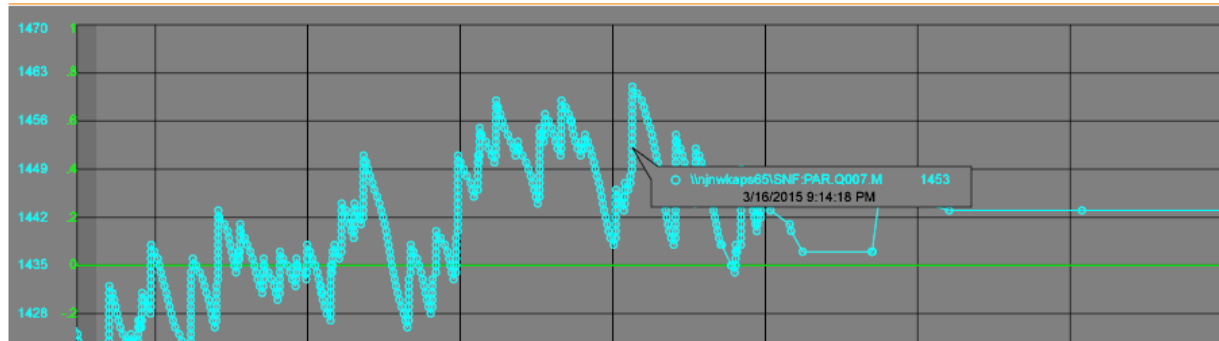
## PI Data Time Range

Start Time: \*60d End Time: \* Apply [Refresh] [Previous] [Next]

## PI Points

Alias	Descriptor	Tag Name	Units	Source	Time	Current Value
COUNTER	# 2 PAR AUTO GRD DEV CTR	SNF:PAR.R002.M	Ctrs	Inspection	4/15/2015 12:00:00 PM	
ESOC LOAD IN MVA	NEWFREEDOM W-2223 PAR MVA	SNF:PAR.ED02.Q	MVA	ESOC	4/15/2015 8:58:11 AM	0
GAS DETECTION RELAY	#2PAR W-2223 GAS DET RLY EXC	SNF:PAR.P005.M		Inspection	4/15/2015 12:00:00 PM	
HYDRAN PPM	NFREEDOM 2PAR EXCITER GAS	SNF:PAR.Q007.M	PPM	ESOC	4/16/2015 11:19:02 AM	1443
HYDRAN ROC	# 2 Phase Angle Regulator (W-2223) Hydran PPM	SNF:PAR.Q007.N1	Deg C		3/20/2015 3:00:00 AM	0
MAX LIQUID #2 TEMP	#2PAR W-2223 MAX LIQ #2 EXC	SNF:PAR.T005.M	Deg F	Inspection	4/15/2015 12:00:00 PM	
MAX WINDING TEMP	#2 PARH W-2223 MAXWVG #1TMP	SNF:PAR.T007.M	Deg F	Inspection	4/15/2015 12:00:00 PM	
MAX WINDING # TEMP	#2 PARH W-2223 MAXWVG #1TMP	SNF:PAR.T007.M	Deg F	Inspection	4/15/2015 12:00:00 PM	
MAX WINDING #2 TEMP	#2 PARH W-2223 MAXWVG #2TMP	SNF:PAR.T008.M	Deg F	Inspection	4/15/2015 12:00:00 PM	
PIML COOLING PERFORM	#2 PAR EXC W-2223 OIL/AMB DIFF	SNF:CPR.TD11	Deg C		4/15/2015 12:00:00 PM	5
SF-6 GAS PRESSURE	#2 PAR GRD DEV GAS PRES	SNF:PAR.P002.M	psi	Inspection	4/15/2015 12:00:00 PM	
TANK OIL LEVEL	#2 PARH W-2223 OIL LVL	SNF:PAR.LD01.M		Inspection	4/15/2015 12:00:00 PM	
W-2223 PAR MVA	NEWFREEDOM W-2223 PAR MVA	SNF:PAR.ED02.Q	MVA	ESOC	4/15/2015 8:58:11 AM	0
W-2223 PAR MVAR	NEW FRDM W-PAR MVAR	SNF:PAR.ED04.Q	MVAR	ESOC	4/15/2015 8:58:11 AM	0
W-2223 PAR MW	NEW FRDM W-PAR MW	SNF:PAR.ED02.W	MW	ESOC	4/15/2015 8:58:11 AM	0

## PI Data Trend





# Benefits

- Have been very successful in the past 13 years identifying problems and remediating issues before a failure
- Extremely valuable system when you have
  - \$5 B of installed assets with a replacement value > 13B
  - Average age of the assets exceeds 40 years
  - All equipment is expected to be **used and useful** all the time
- Justify millions of dollars in saving over past 13 years in equipment failure avoidance
- No secret sauce for success – program success is contributed to Asset Engineer's commitment to program and data owners ensuring data integrity.

# 2015 Examples

Substation/Designation	Findings	Action	Estimated Savings
Culver Ave 4002 Unit Sub	Elevated DGA readings	Drain OLTC and perform internal inspection. Found selector switch contacts coked because of OLTC lock into position. Operate OLTC manually, clean contacts and replace old sullied oil with new to enhance the life of the OLTC and unit sub.	\$500k save by avoiding unit transformer failure
Polk St. #3 Transformer	IR scan indicates hot-spot	Drain and inspect OLTC, found oil highly carbonized and sludge. Rust in OLTC compartment from water seepage from cap on top of OLTC. Repair leaks, paint rusted section; wipe and wash clean OLTC of sludge. Refill OLTC with new oil. These actions have enhanced the life of the transformer.	\$500k save by avoiding transformer failure
Centex Towers Unit Sub 300	IR scan indicates hot-spot in the OLTC compartment	Drain and inspect OLTC, found heavy oil sludge and low oil level. Wash OLTC clean of sludge and replace oil with new to the correct level. This action has enhanced the life of the transformer.	\$750k save by avoiding transformer failure

# Energy Strong

# Superstorm Sandy



<b>Customers</b>	<b>2,000,000</b>	
<b>Tree Locations</b>	<b>48,000</b>	
<b>Poles</b>	<b>2,400</b>	
<b>Circuits</b>		<b>2,9</b>
<b>Services</b>		<b>8,3</b>
<b>Substations</b>	<b>30</b>	





# Energy Strong Filing

- A Proposal To Invest in New Jersey's Future
  - **\$620 million** to raise, relocate or protect 29 switching and substations that were damaged by water in recent storms.
  - **\$100 million** to create redundancy in the system, reducing outages when damage occurs.
  - **\$100 million** to deploy smart grid (advanced) technologies to improve storm/emergency response and improve customer communications.

# Energy Strong – Advanced Technology & CMMS

- Automate 80% of Distribution Circuits
- Support ES data & expansion of non-operational data path
  - Transformer Monitoring
  - Pumping Plants
  - Gas Insulated Switchgear
- Need to make CMMS more reliable, scalable & sustainable
- Critical in terms of asset failure avoidance



	Class H 230-13kv	Class A&B 26-4kv	Total
<b>Planned Total stations:</b>	<b>53</b>	<b>41</b>	<b>94</b>
<b>Planned Total feeders:</b>	<b>632</b>	<b>266</b>	<b>1046</b>

# PSEG

# Project Management

# CMMS Project Details

- Project Duration
  - 14-months (May 2014 to Feb 2016)  
Go-Live in mid-Nov 2015
- Vendors Involved:
  - Accenture® - PI System Integration
  - TCS® - SQL Integration
  - OSIsoft® (Licenses)
  - Microsoft® (Licenses)

# CMMS Before and After

## Original CMMS State

- Windows Server 2003 out of support
- Physical servers deployed
- No server redundancy for PI System or SQL
- No secondary site in the event the main datacenter went offline
- PI Com Connector provided slow data retrieval from Operations PI Server (outdated software)
- Use of PI System users and groups made security management difficult
- Need to integrate further data sources into the PI System



## CMMS Project Outcomes

- Updated to Windows Servers 2012
- All servers were implemented as Virtual Servers
- Implemented a Test environment that mimics the Production environment
- Create a monitoring system to check server status
- Implemented High Availability
- Implemented a Disaster Recovery environment
- Easier security management by using Active Directory

## Project Scope (In-Scope)

- PI System Architecture Upgrade
  - 150K tags to 400K tags
- Overall PI System Software Upgrade
- SQL Server Upgrade
- Connectivity into our Transmissions / Distribution systems

## Project Scope (In-Scope)

- Connectivity into our external data feeds (i.e. SAP, DeltaX, Doble, CAD, OMS, GIS)
- CMMS Reporting
  - PI WebParts
- Implementation of a Disaster Recovery Environment
- Implementation of High Availability



## Project Scope (Out-Of-Scope)

- Upgrade / replacement of PI Manual Logger (included in another PSEG project)
- Upgrade of Transmission / Distribution systems that connect with CMMS
- Upgrade of PSEG Mobile laptops
- Implementation of the CMMS platform in PSEG Long Island
- Any external interface upgrades

# CMMS Project Risk Management

CMMS, being a high visibility project due to its dependencies on Energy Strong funding required a proactive risk monitoring and mitigation

Risk Identification	Probability	Impact	Outcome
RLINK release delayed	3	5	Obtained recent RLINK. Kept in close communication with Product Manager
Compatibility issues with PSEG Mobile laptops	2	4	Was able to set up a separate environment to be able to test
New PI SDK not compatible with new solution	3	3	All users will be able to connect to the new environment
Errors in original platform are carried over to new CMMS	5	4	All errors that were carried over were remediated
Data migration and/or validation issues encountered	2	4	Refreshed data frequently to ensure accurate data validation
Firewall changes not implemented in time	2	3	All firewalls required were open to allow connectivity
SQL AlwaysOn implementation delayed or incomplete	3	3	Brought in Microsoft SQL experts to assist in installation

# CMMS Project Lessons Learned

Lesson Learned	Lesson Learned Description	Recommendations
<b>CMMS Overall Team (Multi-vendor, distributed)</b>	Team co-location worked well for design sessions	A separate area should be reserved in order for team members to work without distractions (i.e. team conference calls)
	As team members came into project at different stages a lack of understanding on technical decisions made led to confusion due to multi-vendor, distributed team resources in this 14-month long project	Hold design sessions before each phase of implementation to ensure clarity among all team members, vendors, and PSEG personnel
	At points throughout the project, it was unclear the Roles and Responsibilities of each vendor.	Set clear expectations for each vendor initially

# CMMS Project Lessons Learned - Continued

Lesson Learned	Lesson Learned Description	Recommendations
<b>Deployment</b>	<p>We did not have a test environment for PI Coresight. We did a quick test to ensure we could connect to the new environment. However, during implementation PI Coresight had a lot of issues connecting to the new environment.</p>	<p>Create test environment for all production software</p>
	<p>There were instances where services and interfaces were shut off. Looking at the logs, it was unclear as to who / what might have caused this.</p>	<p>During deployment, make sure that tighter IT security control on servers are enforced to allow for traceability of changes</p>

# Technical Design & Implementation Accenture

# PSEG CMMS Project Vision

Establish a state-of-the-art and modernized PI System architecture to support the business and functional requirements of CMMS data acquisition and historization, condition assessment and condition based maintenance, system security, and display and visualization

## Provide System Scalability

- Add data integration for enhance calculations
- Ability to sustainably add new asset classes



## Improve System Reliability

- Add control center-level reliability (DR)
- Add failover for data sources



## Enhance Security & Centralization

- Centralization of distributed servers
- Enhance user and application security



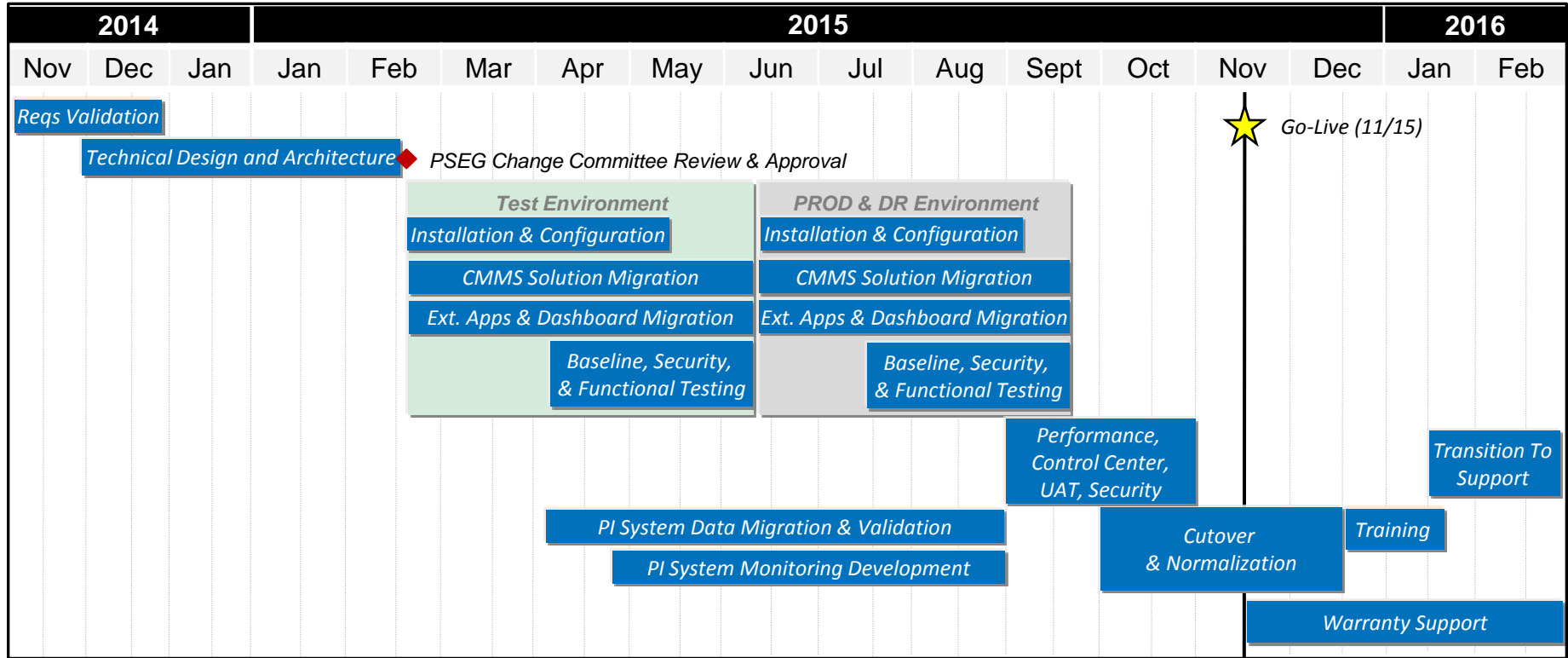
## Improve System Supportability

- Improved visibility into system performance and health
- Predictability of system behavior

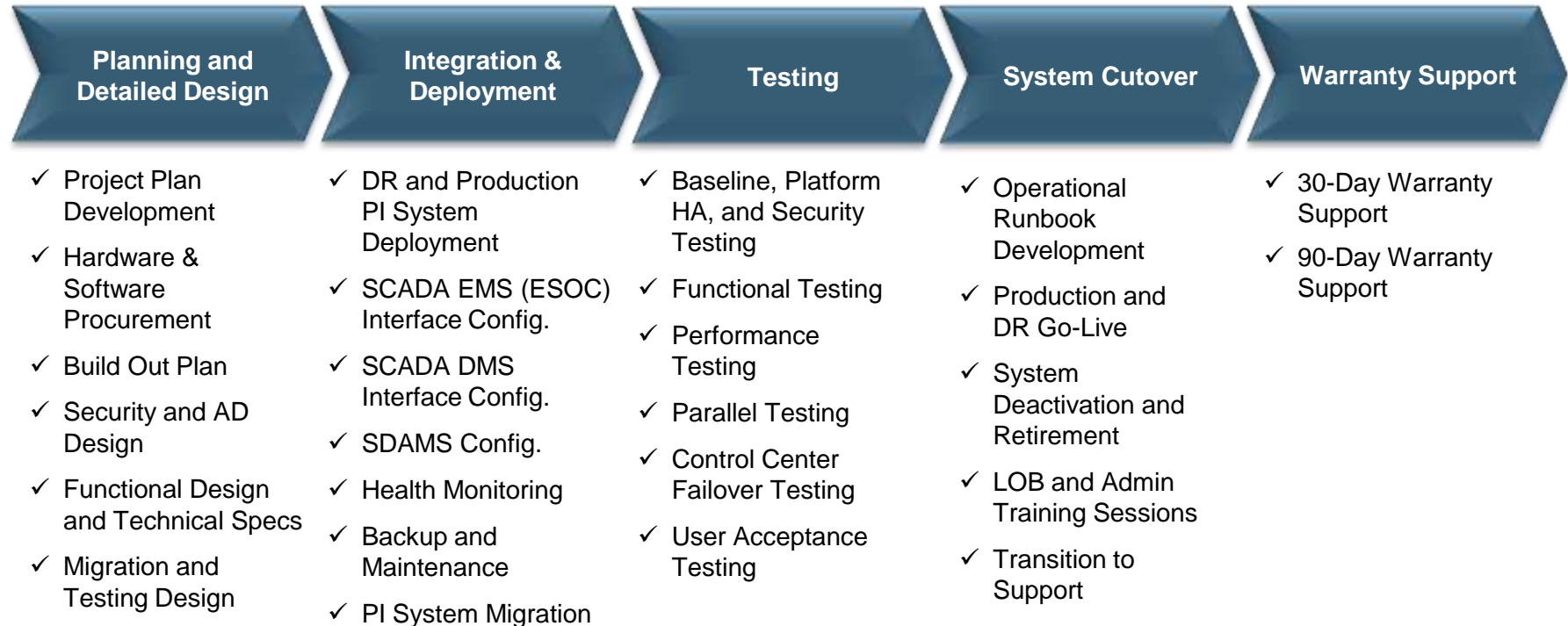


Asset Maintenance and Condition Assessment Platform (CMMS)

# CMMS PSEG Project Timeline



# CMMS Project Deliverables

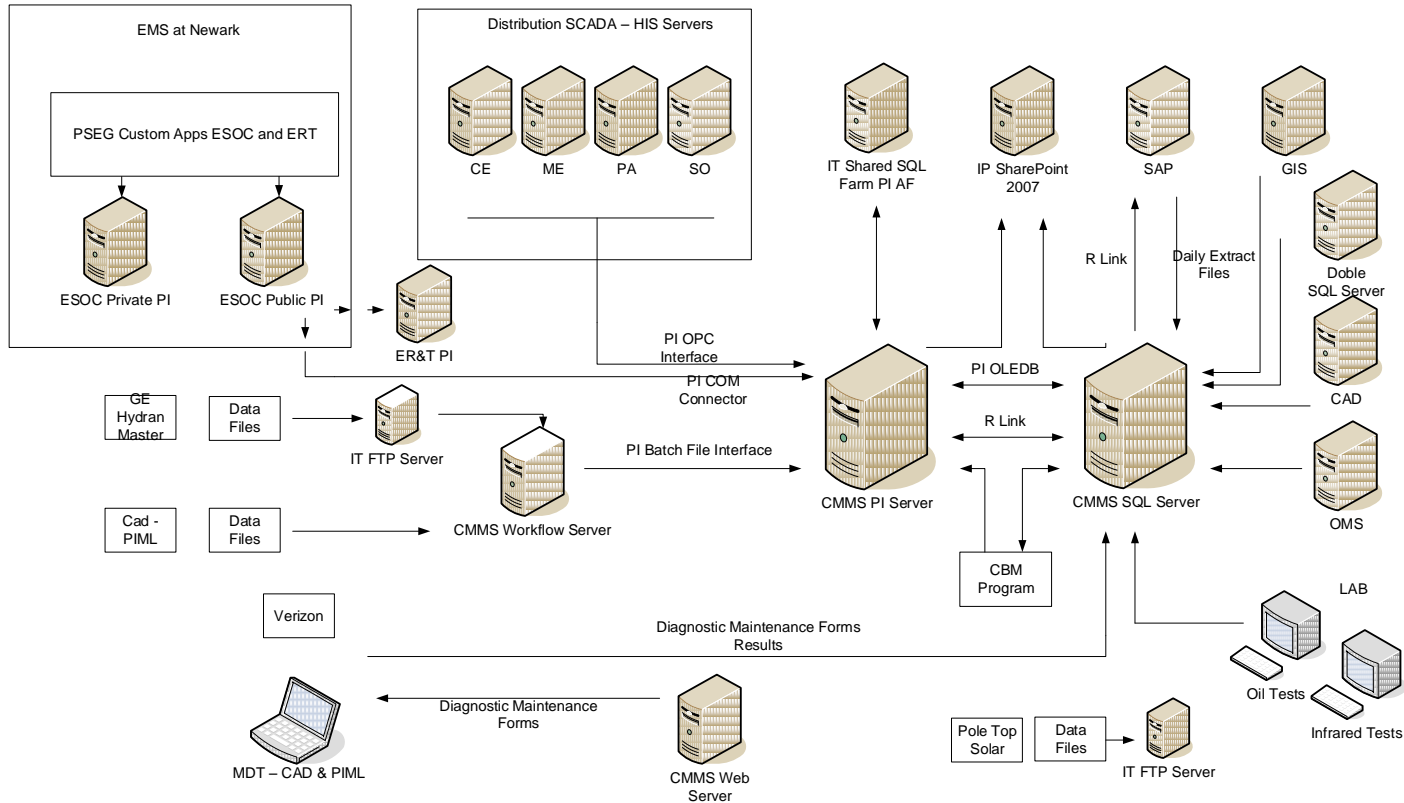




# Architecture Design Considerations

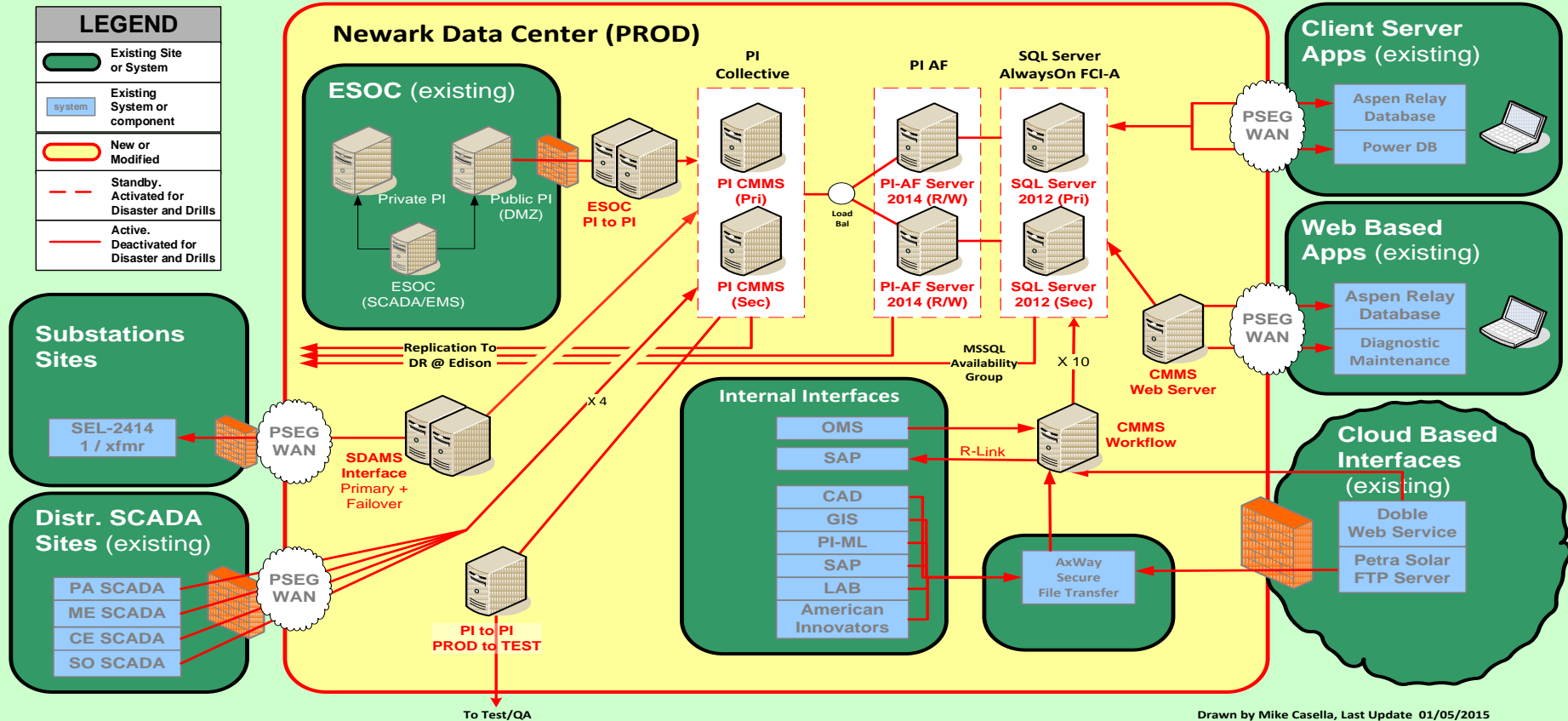
- ✓ Provide **control center-level failover** so that in the case the Newark control center (Primary) is offline, the PI System at Edison/DR (Backup) can be activated
- ✓ Provide CMMS **Test environment** for safe testing of applications before release to Production
- ✓ Elimination of architecture **points of failure** by implementation of **High Availability** for Data Archives in all environments
- ✓ Provide **interface failover** to minimize data loss situations
- ✓ PI System (merge) data migration and validation for 10+ years of data from multiple Data Archives allowing **consolidation and centralization** of data
- ✓ Decommission outdated software such as PI COM Connector

# CMMS PI System Platform - Legacy



# ENERGY STRONG – CMMS PI HISTORIAN – PRODUCTION

LEGEND	
	Existing Site or System
	Existing System or component
	New or Modified
	Standby. Activated for Disaster and Drills
	Active. Deactivated for Disaster and Drills



Drawn by Mike Casella, Last Update 01/05/2015

# ENERGY STRONG – CMMS PI HISTORIAN – DR

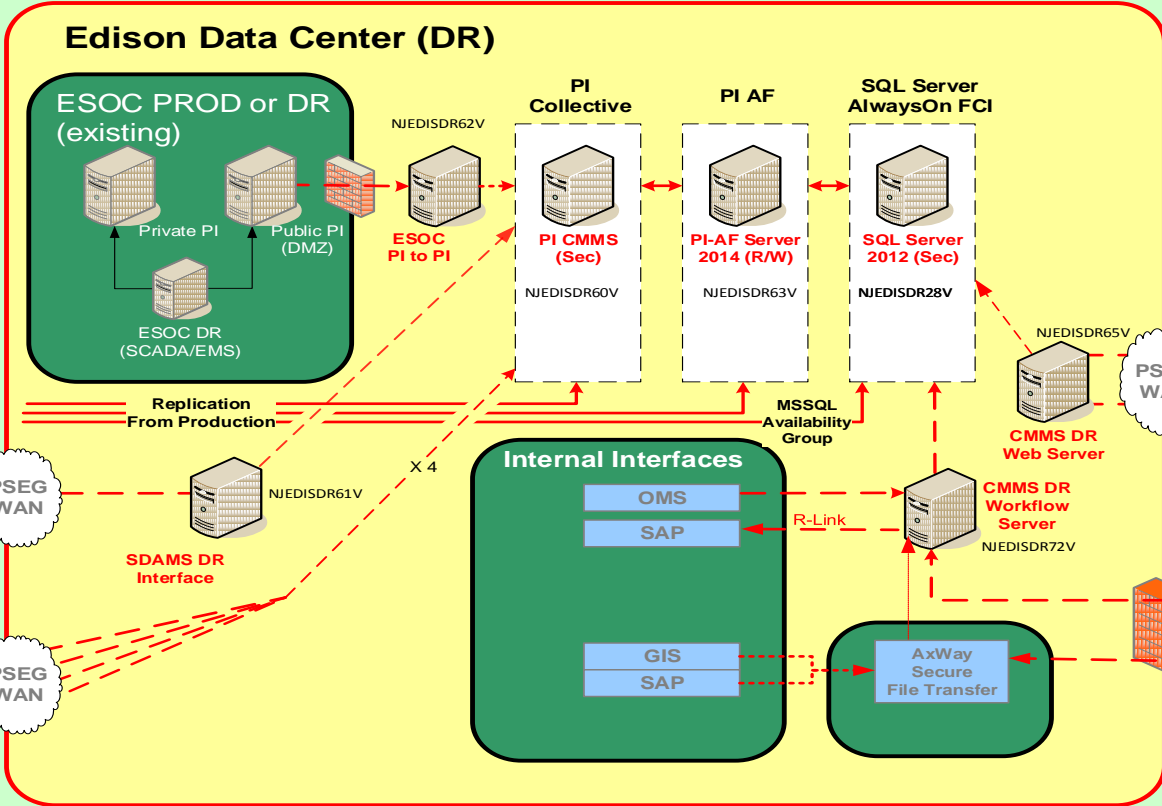
LEGEND	
	Existing Site or System
	Existing System or component
	New or Modified
	Standby. Activated for Disaster and Drills
	Active. Deactivated for Disaster and Drills

**Substations Sites (existing)**  
(Transformer Monitoring)

SEL-2414 1 / xfmr

**Distr. SCADA Sites (existing)**

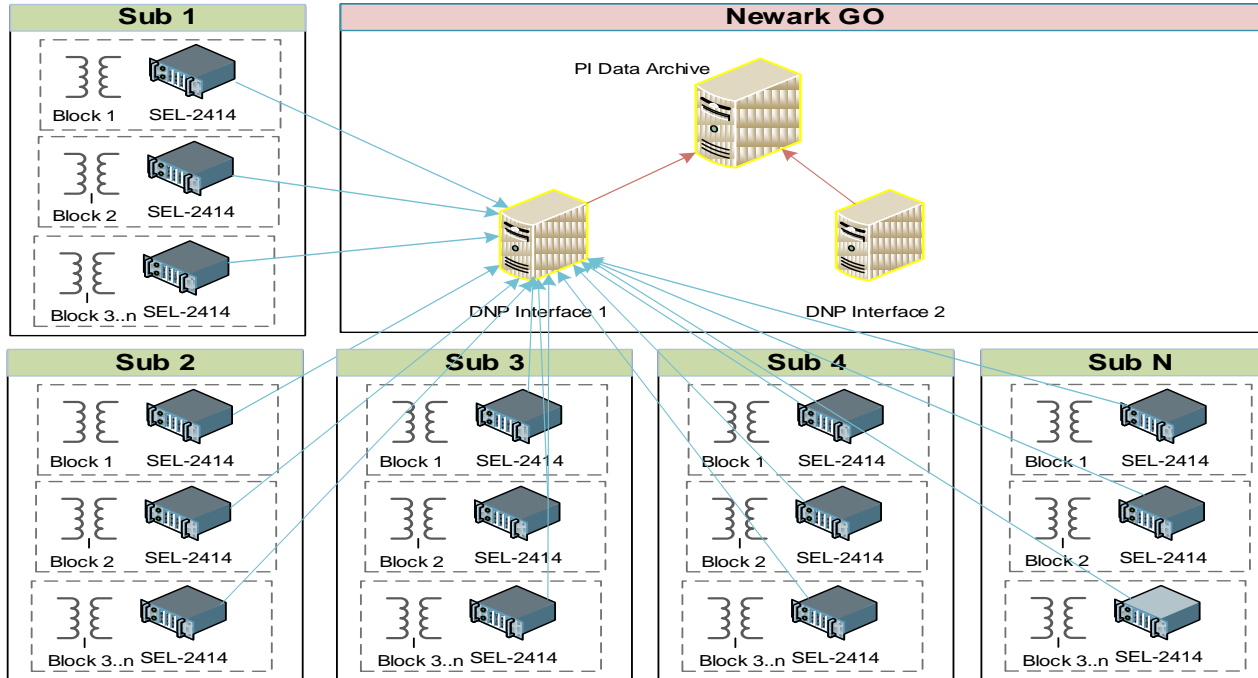
PA SCADA  
ME SCADA  
CE SCADA  
SO SCADA



Drawn by Mike Casella, Last Update 11/21/2014

# Non-Operational Data Collection

111 Substations  
276 Transformers



# Substation Monitoring (SDAMS)

Target Audience: Asset Strategy Team (LOB)

Elements

- Elements
  - CENTRAL REGION
  - METRO REGION
  - PALISADES REGION
  - SOUTHERN REGION
  - Element Searches

Elements Group by:  Category  Temp

Search

	Name	Description	Category	Type	Template
<input type="checkbox"/>	CENTRAL REGION			None	
<input type="checkbox"/>	METRO REGION			None	
<input type="checkbox"/>	PALISADES REGION			None	
<input type="checkbox"/>	SOUTHERN REGION			None	

- Elements
- Event Frames
- Library
- Unit of Measure
- MyPI
- Notifications
- Contacts

# Substation Monitoring (SDAMS)

Target Audience: Asset Strategy Team (LOB)

brary

- SDAMS (DONT TOUCH)
  - Categories
    - Analysis Categories
    - Attribute Categories
    - Element Categories
    - Reference Type Categories
    - Table Categories
  - Templates
    - Element Templates
      - Parent Template\_PROLEC
      - SDAMS FINAL
      - SUBSTATION LEVEL TEMPLATE**
    - Event Frame Templates
    - Model Templates
    - Notification Templates
    - Transfer Templates
  - Enumeration Sets
  - Reference Types
  - Tables
    - dnp assets
    - Parent
    - STATION
    - Table6
  - Table Connections

Elements

Event Frames

Library

SUBSTATION LEVEL TEMPLATE

General Attribute Templates Ports Analysis Templates

Filter

Name	Description	Default Value	Settings...
Category: Substation Information			
FLOC KEY		0	
Substation Current Status			SELECT [Current_Status] FROM STATION W...
Substation FLOC		0	SELECT [floc_num] FROM STATION WHERE [...]
Substation Name		0	SELECT [E-STATION-NAME] FROM STATION ...

Group by:  Category  Te

Name: FLOC KEY

Description:

Configuration Item:  Index

Categories: Substation Information

Default UOM: <None>

Value Type: Double

Default Value: 0

Data Reference: <None>

Settings...

# Substation Monitoring (SDAMS)

Target Audience: Asset Strategy Team (LOB)

SDAMS FINAL

General Attribute Templates Ports Analysis Templates

Filter

Name	Description	Default Value	Settings...
<b>Category: Amps</b>			
A PH AMPS		0 A	\\%Server%\%@.  A Ph%
A Ph		0	SELECT tag FROM Table6 WHERE [Equip_Num] = @[Equipment Numb...
B PH AMPS		0 A	\\%Server%\%@.  B Ph%
C PH AMPS		0 A	\\%Server%\%@.  C Ph%
<b>Category: LTC</b>			
LTC POSITION		0	\\%Server%\%@.  LTC P%
LTC TANK TEMPERATURE		0	\\%Server%\%@.  LTC tank%
<b>Category: Manual Input</b>			
Equipment Number		0000000001...	
<b>Category: SAP</b>			
Device Phase			SELECT [E-TRANSF-CONFIG] FROM Parent WHERE edescr = @[Equipm...
Device Rating		0	SELECT [E-TRANSF-RATING] FROM Parent WHERE edescr = @[Equipm...
Equipment Class		SUBSTATION	
Equipment Description		Power Transfo...	
Equipment Type		E-TRF-TRF	
MANUFACTURER			SELECT Manufacturer FROM Parent WHERE [Equip_Num] = @[Equipme...
Model Number		0	SELECT [Model_Num] FROM Parent WHERE [Equip_Num] = @[Equipme...
Serial Number			SELECT [Serial_Num] FROM Parent WHERE [Equip_Num] = @[Equipme...

Group by:  Category  Template

Name: A Ph

Description:

Configuration Item:  Indexed:

Categories:

Default UOM: <None>

Value Type: String

Default Value: 0

Data Reference: Table Lookup

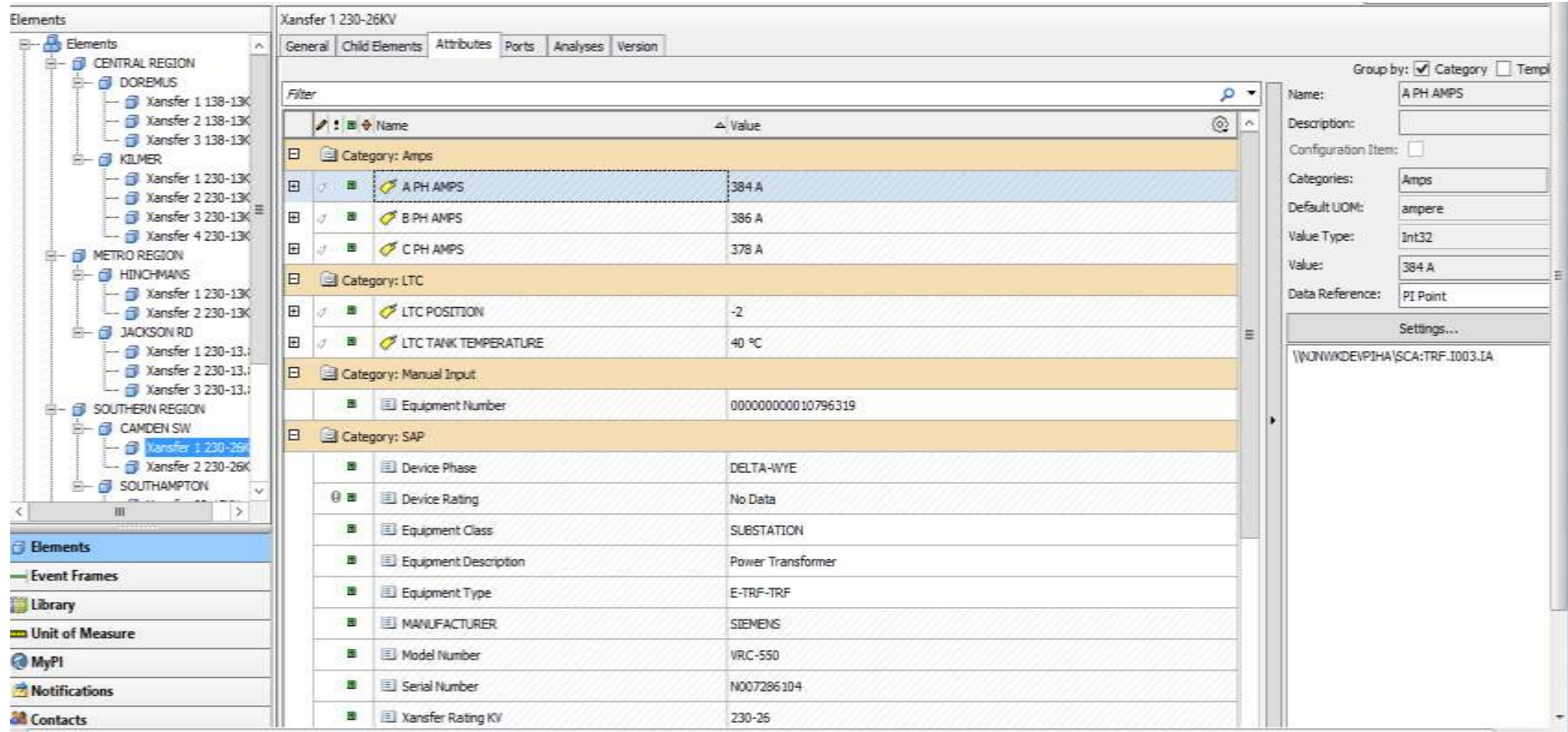
Settings...

```
SELECT tag FROM Table6 WHERE [Equip_Num] =
@[Equipment Number]AND alias LIKE 'A PH
AMPS' ORDER BY alias
```



# Substation Monitoring (SDAMS)

Target Audience: Asset Strategy Team (LOB)



The screenshot displays the SDAMS software interface. On the left is a tree view of the system hierarchy, including regions like CENTRAL, KILMER, METRO, and SOUTHERN, with various Xansfer units listed. The main window shows the configuration for 'Xansfer 1 230-26KV'. Below the title bar are tabs for General, Child Elements, Attributes, Ports, Analyses, and Version. A filter bar is present above a table of data points. The table is organized into categories: Amps, LTC, Manual Input, and SAP. The 'Amps' category is currently selected, showing three rows for A PH AMPS, B PH AMPS, and C PH AMPS. The right-hand pane shows configuration details for the selected 'A PH AMPS' item, including Name, Description, Configuration Items, Categories, Default UOM, Value Type, Value, and Data Reference.

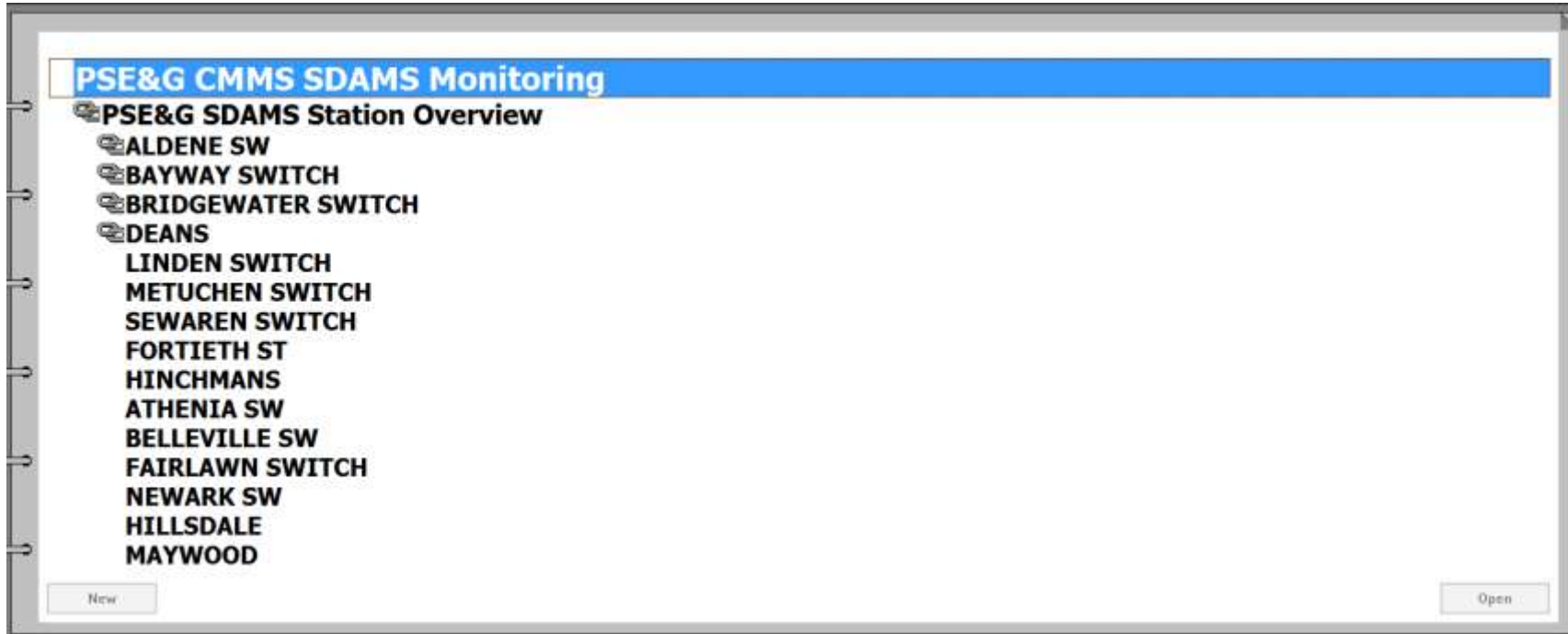
Category	Name	Value
<b>Category: Amps</b>		
✓	A PH AMPS	384 A
✓	B PH AMPS	386 A
✓	C PH AMPS	378 A
<b>Category: LTC</b>		
✓	LTC POSITION	-2
✓	LTC TANK TEMPERATURE	40 °C
<b>Category: Manual Input</b>		
	Equipment Number	00000000010796319
<b>Category: SAP</b>		
	Device Phase	DELTA-WYE
	Device Rating	No Data
	Equipment Class	SUBSTATION
	Equipment Description	Power Transformer
	Equipment Type	E-TRF-TRF
	MANUFACTURER	SIEMENS
	Model Number	VRC-550
	Serial Number	N007286104
	Xansfer Rating KV	230-26

Configuration details for 'A PH AMPS':

- Name: A PH AMPS
- Description:
- Configuration Items:
- Categories: Amps
- Default UOM: ampere
- Value Type: Int32
- Value: 384 A
- Data Reference: PI Point

Settings...  
 {WUNWDEVPIHA}SCA:TRF\_1003.IA

# Substation Monitoring Dashboards (SDAMS)



The screenshot shows a software interface for monitoring substation equipment. At the top, there is a blue header bar with the text "PSE&G CMMS SDAMS Monitoring". Below this, a main menu area is titled "PSE&G SDAMS Station Overview". Underneath, a list of substation names is displayed, each preceded by a small icon of a substation. The list includes: ALDENE SW, BAYWAY SWITCH, BRIDGEWATER SWITCH, DEANS, LINDEN SWITCH, METUCHEN SWITCH, SEWAREN SWITCH, FORTIETH ST, HINCHMANS, ATHENIA SW, BELLEVILLE SW, FAIRLAWN SWITCH, NEWARK SW, HILLSDALE, and MAYWOOD. At the bottom left of the interface is a "New" button, and at the bottom right is an "Open" button.

**PSE&G CMMS SDAMS Monitoring**

**PSE&G SDAMS Station Overview**

- ALDENE SW
- BAYWAY SWITCH
- BRIDGEWATER SWITCH
- DEANS
  - LINDEN SWITCH
  - METUCHEN SWITCH
  - SEWAREN SWITCH
  - FORTIETH ST
  - HINCHMANS
  - ATHENIA SW
  - BELLEVILLE SW
  - FAIRLAWN SWITCH
  - NEWARK SW
  - HILLSDALE
  - MAYWOOD

New Open

# Substation Monitoring Dashboards (SDAMS)

Target Audience: Asset Strategy Team (LOB)

## PSE&G SDAMS STATION OVERVIEW

**Legend**

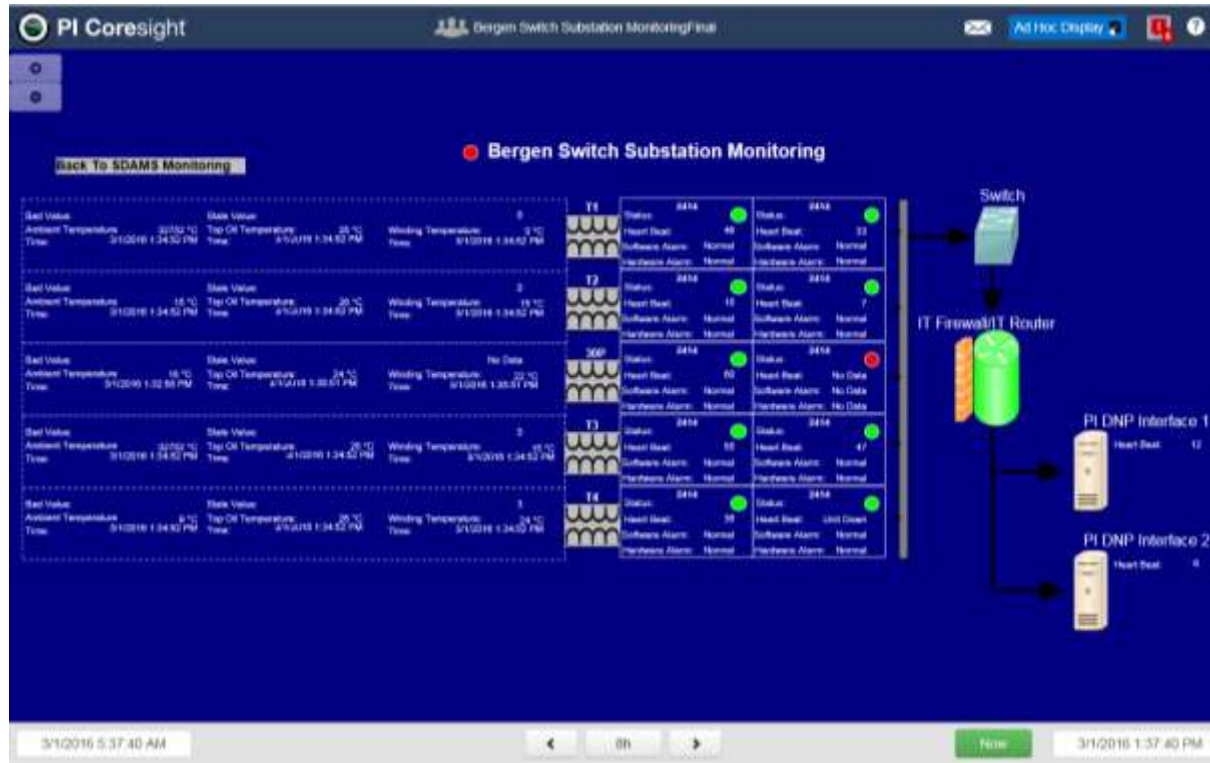
- Functioning as expected
- Off/Error/Failed
- In Progress
- Bad Data

Central	Metro	Palisades	Southern
<span style="color: red;">●</span> <a href="#">Belleville</a>	<span style="color: red;">●</span> <a href="#">Athenia</a>	<span style="color: red;">●</span> <a href="#">Bayonne Switch</a>	<span style="color: red;">●</span> <a href="#">Burlington Switch</a>
<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Camden Switch</a>
<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Fairlawn Switch</a>	<span style="color: green;">●</span> <a href="#">East Rutherford Switch</a>	<span style="color: green;">●</span> <a href="#">Camden Switch</a>
<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Fairlawn Switch</a>	<span style="color: green;">●</span> <a href="#">East Rutherford Switch</a>	<span style="color: green;">●</span> <a href="#">Camden Switch</a>
<span style="color: green;">●</span> <a href="#">Linden Switch</a>	<span style="color: green;">●</span> <a href="#">Fortieth St</a>	<span style="color: green;">●</span> <a href="#">Hillsdale</a>	<span style="color: green;">●</span> <a href="#">Clarkville</a>
<span style="color: green;">●</span> <a href="#">Metuchen Switch</a>	<span style="color: green;">●</span> <a href="#">Hinchmans</a>	<span style="color: green;">●</span> <a href="#">Maywood</a>	<span style="color: green;">●</span> <a href="#">Crosswicks</a>
<span style="color: green;">●</span> <a href="#">Sewaren Switch</a>	<span style="color: green;">●</span> <a href="#">Newark SW</a>	<span style="color: green;">●</span> <a href="#">Maywood</a>	<span style="color: green;">●</span> <a href="#">Cuthbert BLVD</a>
		<span style="color: green;">●</span> <a href="#">Belleville SW</a>	<span style="color: green;">●</span> <a href="#">Gloucester</a>
			<span style="color: green;">●</span> <a href="#">Kuser RD</a>
			<span style="color: green;">●</span> <a href="#">Lawrence SUR</a>
			<span style="color: green;">●</span> <a href="#">Lawrence Switch</a>
			<span style="color: green;">●</span> <a href="#">Levittown</a>
			<span style="color: green;">●</span> <a href="#">Marlton</a>
			<span style="color: green;">●</span> <a href="#">South Hampton</a>

WorkBook

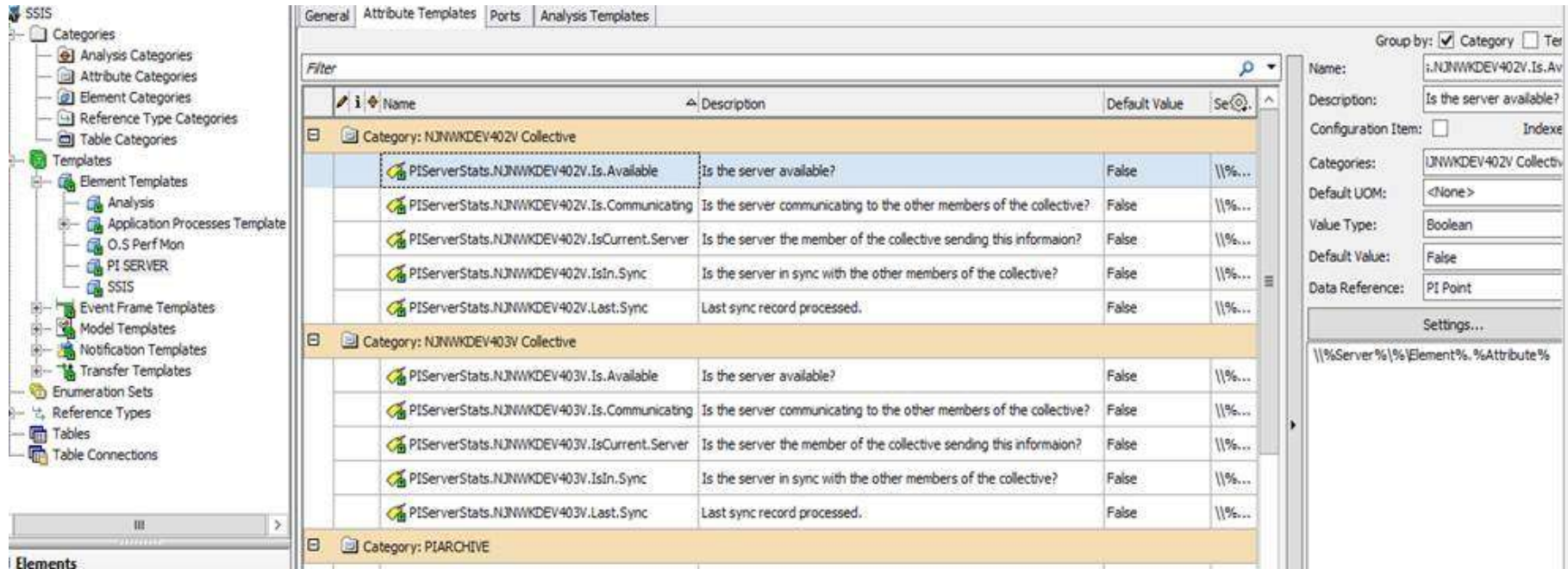
# Substation Monitoring Dashboards (SDAMS)

Target Audience: Asset Strategy Team (LOB)



# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team



The screenshot displays the configuration tool interface for monitoring server status. The main window shows a table of attributes grouped by category. The selected attribute, 'PIServerStats.NJNWKDEV402V.Is.Available', has its properties shown in the right-hand pane.

Name	Description	Default Value	Se...
<b>Category: NJNWKDEV402V Collective</b>			
PIServerStats.NJNWKDEV402V.Is.Available	Is the server available?	False	%...
PIServerStats.NJNWKDEV402V.Is.Communicating	Is the server communicating to the other members of the collective?	False	%...
PIServerStats.NJNWKDEV402V.Is.Current.Server	Is the server the member of the collective sending this informaion?	False	%...
PIServerStats.NJNWKDEV402V.IsIn.Sync	Is the server in sync with the other members of the collective?	False	%...
PIServerStats.NJNWKDEV402V.Last.Sync	Last sync record processed.	False	%...
<b>Category: NJNWKDEV403V Collective</b>			
PIServerStats.NJNWKDEV403V.Is.Available	Is the server available?	False	%...
PIServerStats.NJNWKDEV403V.Is.Communicating	Is the server communicating to the other members of the collective?	False	%...
PIServerStats.NJNWKDEV403V.Is.Current.Server	Is the server the member of the collective sending this informaion?	False	%...
PIServerStats.NJNWKDEV403V.IsIn.Sync	Is the server in sync with the other members of the collective?	False	%...
PIServerStats.NJNWKDEV403V.Last.Sync	Last sync record processed.	False	%...
<b>Category: PIARCHIVE</b>			

**Properties for Selected Attribute:**

- Name: i:NJNWKDEV402V.Is.Av
- Description: Is the server available?
- Configuration Item:  Indexe
- Categories: NJNWKDEV402V Collectv
- Default UOM: <None>
- Value Type: Boolean
- Default Value: False
- Data Reference: PI Point

**Settings...**

```
||%Server%|%Element%.%Attribute%
```



# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team

Elements

- CMMS:SSIS
- NJNWKDEV402V
- NJNWKDEV403V
- NJNWKDEV404V
- PIBUFSS
- PILOGSERV
- PIMSGSS
- PINETMGR
- PItoPI
- NJNWKDEV405V
- NJNWKDEV406V
- NJNWKDEV407V
- NJNWKDEV411A
- NJNWKDEV411B

Element Searches

General		Child Elements	Attributes	Ports	Analyses	Version
Filter						
		Name	Value			
Category: <None>						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Disk(C:).Free_Space	I/O Timeout			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Disk(D:).Free_Space	I/O Timeout			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Disk(Z:).Free_Space	Shutdown			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Memory.Available.MB	I/O Timeout			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Memory.Pages	I/O Timeout			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Processor.C1.Time	I/O Timeout			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Processor.C2.Time	I/O Timeout			

Group by:  Category  Template

Name: Disk(C:).Free\_Space

Description: Free Space is the percentage o

Configuration Item:

Categories:

Default UOM: percent

Value Type: Int16

Value: I/O Timeout

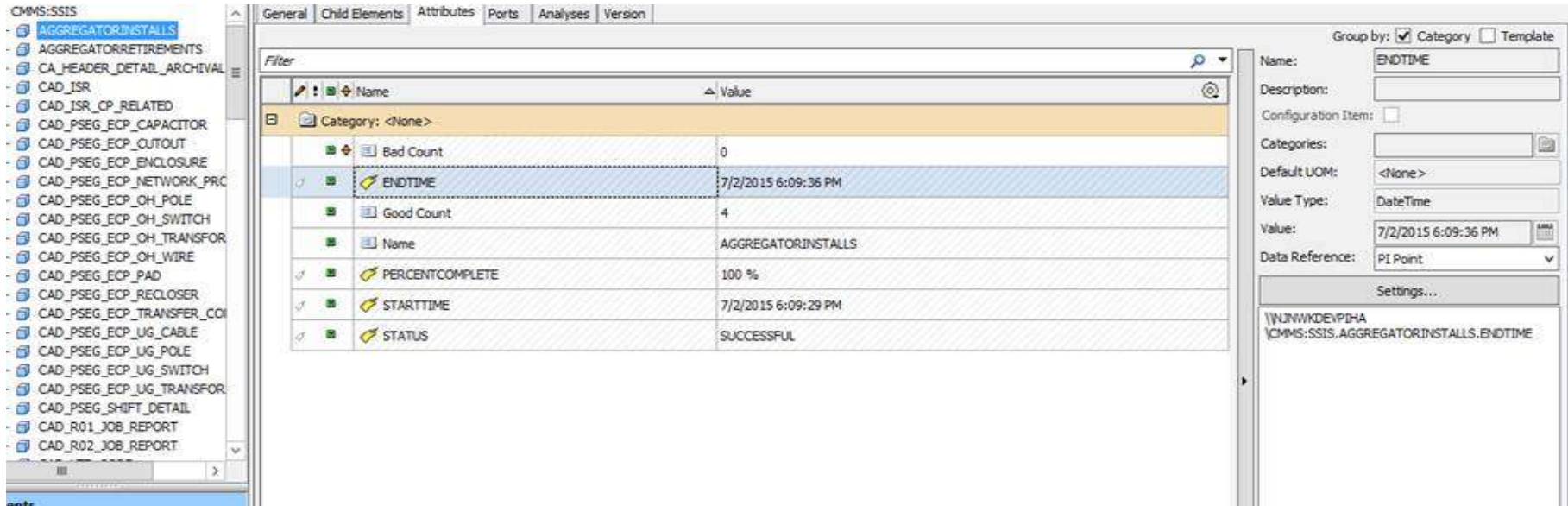
Data Reference: PI Point

Settings...

WJNWKDEVP1A WJNWKDEV404V.Disk(C:).Free\_Space

# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team



The screenshot displays the CMMS software interface. On the left is a tree view of system components, with 'AGGREGATORINSTALLS' selected. The main window shows a table with columns for Name and Value. The 'ENDTIME' row is highlighted. On the right, a properties panel shows details for the selected 'ENDTIME' value.

Name	Value
Category: <None>	
Bad Count	0
<b>ENDTIME</b>	<b>7/2/2015 6:09:36 PM</b>
Good Count	4
Name	AGGREGATORINSTALLS
PERCENTCOMPLETE	100 %
STARTTIME	7/2/2015 6:09:29 PM
STATUS	SUCCESSFUL

Properties Panel (Right):

- Group by:  Category  Template
- Name: ENDTIME
- Description: [Empty]
- Configuration Item:
- Categories: [Empty]
- Default UOM: <None>
- Value Type: DateTime
- Value: 7/2/2015 6:09:36 PM
- Data Reference: PI Point

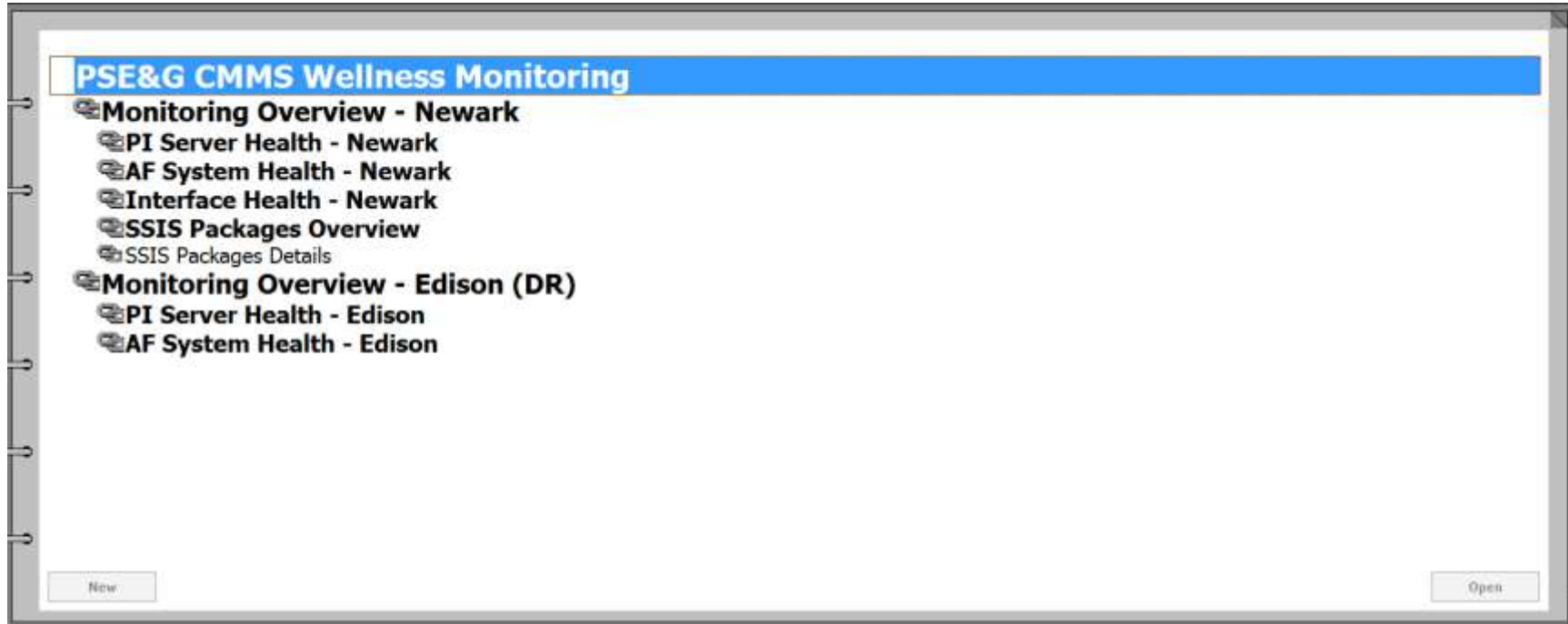
Settings... (Bottom Right):

```

\WINWKDEVPDHA
\CMMS:SSIS.AGGREGATORINSTALLS.ENDTIME
    
```

# CMMS Platform Monitoring (Wellness Check)

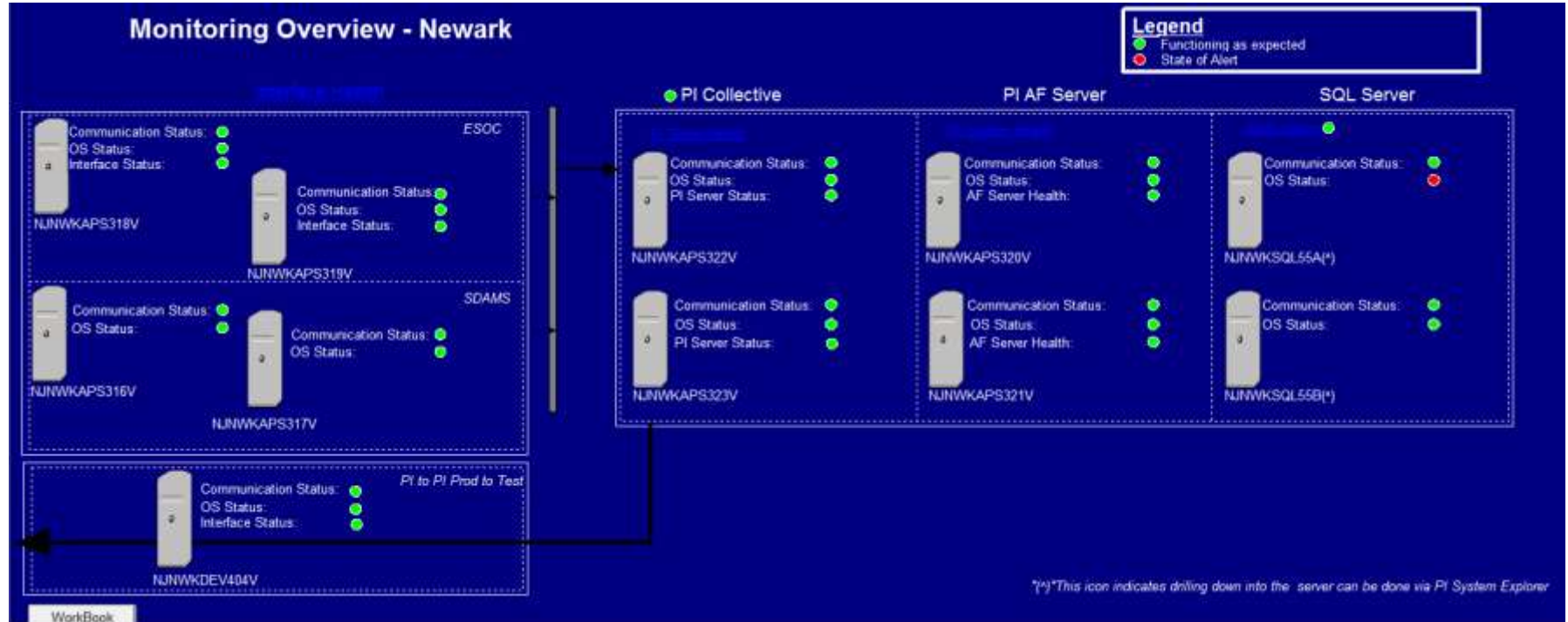
Target Audience: PSEG PI System Support Team





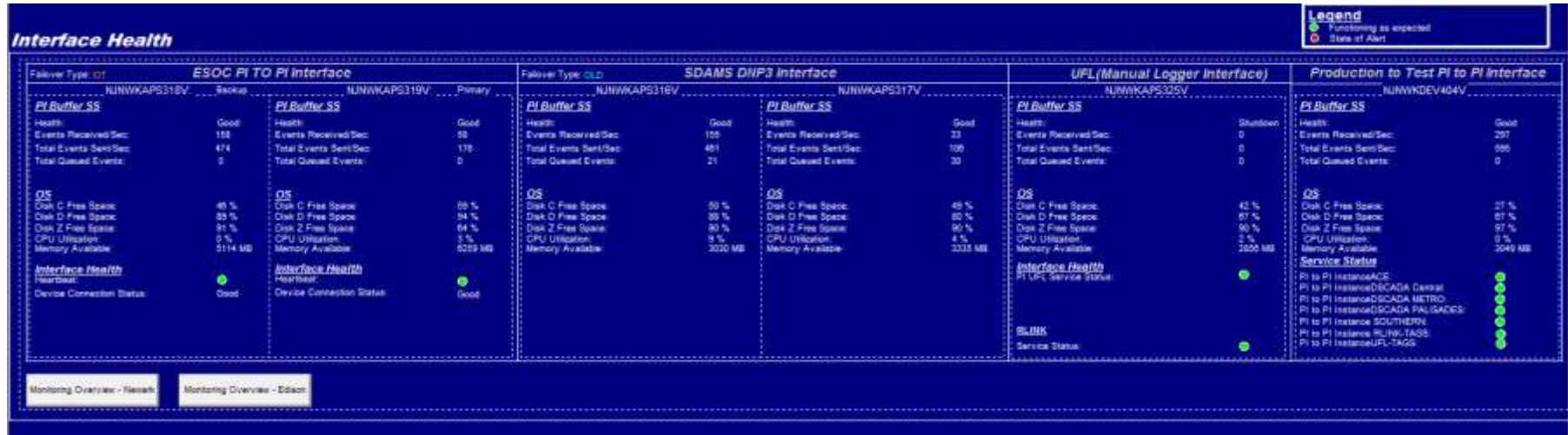
# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team



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Target Audience: PSEG PI System Support Team



# CMMS Platform Monitoring (Wellness Check)

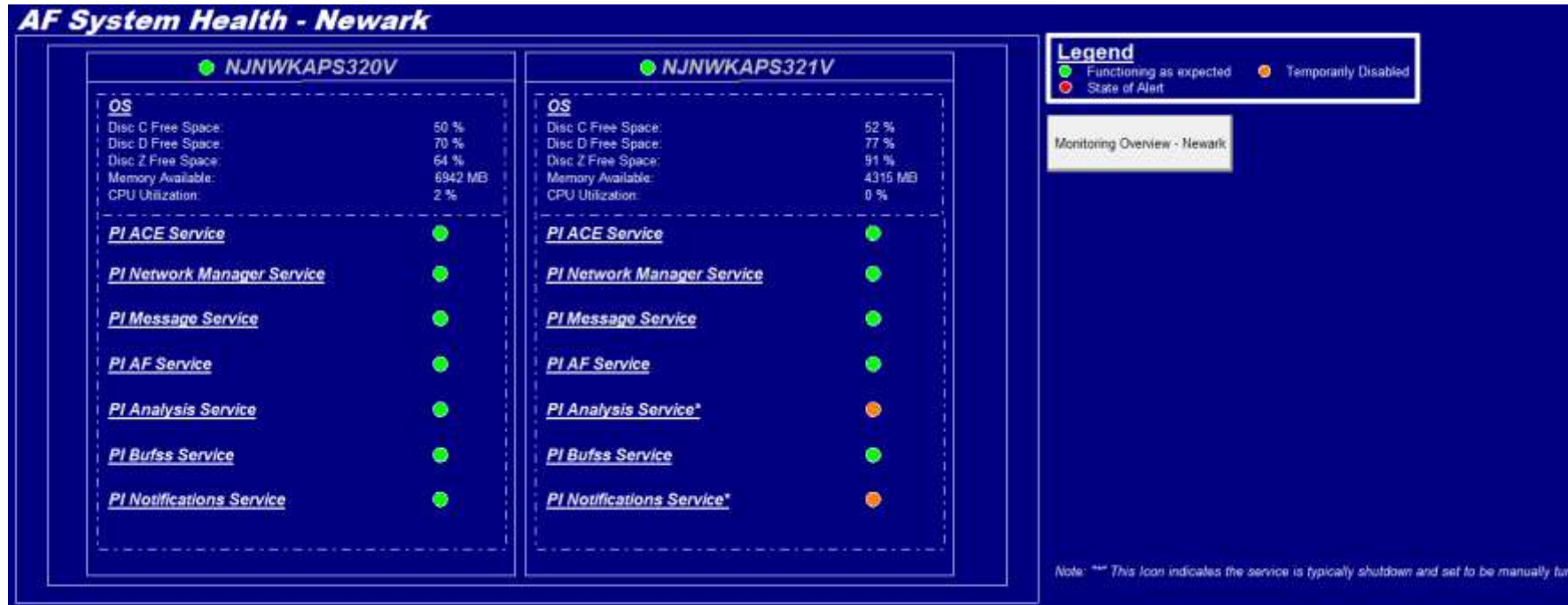
Target Audience: PSEG PI System Support Team

**PI Server Health - Newark** Primary Server: NJNWKAPS322V

● NJNWKAPS322V	● NJNWKAPS323V																																																																																
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<span style="color: green;">●</span> Functioning as expected <span style="color: red;">●</span> State of Alert																																																																																	
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# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team



# CMMS Platform Monitoring (Wellness Check)

Target Audience: PSEG PI System Support Team

SSIS Packages Overview		Legend	
Packages Total: 2		 Functioning as expected	 State of Alert
	 In Progress		
Interfaces	Package		
CAD	<ul style="list-style-type: none"> <li> CAD_ISR</li> <li> CAD_P880_ECP_Catrol</li> <li> CAD_P880_ECP_OH_Transformer</li> <li> CAD_P880_ECP_OH_Pole</li> <li> CAD_P81_ick_Resort</li> <li> CAD_P880_ECP_Brochure</li> <li> CAD_P880_ECP_OH_Wire</li> <li> CAD_P880_ECP_OH_TRANSFORMER</li> <li> CAD_VTB_CODE</li> <li> CAD_P880_ECP_OH_Switch</li> <li> CAD_P880_ECP_Pid</li> <li> CAD_P880_SMPT_DETAL</li> <li> CAD_VTB_NAME</li> <li> CAD_P880_ECP_Resort</li> <li> CAD_P880_ECP_Protect</li> <li> CAD_P880_ECP_Neighbor</li> <li> CAD_ISR_OP_Resort</li> <li> CAD_P880_ECP_OH_Pole</li> <li> CAD_P880_ECP_Terrain_Construction</li> <li> CAD_P880_ECP_OG_Catrol</li> <li> CAD_P880_ECP_Neighbor</li> <li> CAD_P880_ECP_Switch</li> </ul>		
SAP Extract	<ul style="list-style-type: none"> <li> OMS_PannelLocality</li> <li> OMS_Site_Install_1</li> <li> OMS_Opers</li> <li> OMS_Oper_Acts</li> <li> OMS_Cores</li> <li> OMS_Disconnect</li> <li> OMS_ES_CHAPLUPDATE</li> <li> OMS_Equip</li> <li> OMS_Equip_One</li> <li> OMS_HotRegions</li> <li> OMS_FLOOD</li> <li> OMS_ORDERS</li> <li> OMS_Poles</li> <li> OMS_OPERS</li> <li> OMS_ORDERS</li> <li> OMS_Poles</li> <li> HANT_OAHS</li> <li> OAH_OAHS</li> <li> SETTLEMENT_OAHS</li> <li> TSI_OAHS</li> </ul>		
Diode	<ul style="list-style-type: none"> <li> DiodeMtlgMn_GST_DEV</li> <li> DiodeMtlgMn_LIST_DEV</li> <li> DiodeMtlgMn_DEV</li> <li> DiodeMtlgMn_DEV</li> <li> DiodeLessCere_DEV</li> <li> DiodeMtlgMnMtlg_DEV</li> <li> DiodeMtlgMn_DEV</li> <li> DiodeMtlgMn_DEV</li> <li> DiodeMtlgMn_GST_DEV</li> <li> DiodeMtlgMn_LIST_DEV</li> <li> DiodeMtlgMn_DEV</li> <li> DiodeMtlgMn_DEV</li> </ul>		
GIS Distribution Overall Lengths and Underground Cables	<ul style="list-style-type: none"> <li> GIS_Crossing</li> <li> GIS_CONDUCTORSEGMENTTYPE</li> <li> GIS_CAD_NETWORK_TRANFORMERS</li> <li> GIS_CAD_NETWORK_PROTECTORS</li> </ul>		
GIS Pole Top, Tower Details and Relationships	<ul style="list-style-type: none"> <li> Aggregat Issues</li> <li> Aggregat Relationships</li> <li> Pole Issues</li> <li> Pole Relationships</li> </ul>		
PI	<ul style="list-style-type: none"> <li> PVNO_PITAGE_DT3</li> <li> LAMP_PITAGE_DT3</li> <li> LAMP_PITAGE_DT3</li> </ul>		
RELAX	<ul style="list-style-type: none"> <li> LTC_ANALYSIS</li> <li> SAP_OH_Equip_10000</li> </ul>		
OMS	<ul style="list-style-type: none"> <li> OMS DOH</li> <li> OMS POR</li> </ul>		
MS	<ul style="list-style-type: none"> <li> MS_RATINGS</li> <li> MS_OH_LIN_Assess</li> </ul>		
Poles Inter	<ul style="list-style-type: none"> <li> OMS Site Pole</li> <li> Site Access</li> </ul>		
PMS	<ul style="list-style-type: none"> <li> PMS</li> </ul>		
Planners PI Feed	<ul style="list-style-type: none"> <li> PI</li> </ul>		
CAD Files	<ul style="list-style-type: none"> <li> OMS_OAHS_DET3A</li> </ul>		
TORQUE	<ul style="list-style-type: none"> <li> TORQUE_UO</li> </ul>		
CA	<ul style="list-style-type: none"> <li> CA_Reader_Detail_Archive</li> </ul>		

Monitoring Overview - Details      Monitoring Overview - Summary

SSIS Packages Details



# Integration of Portfolio of Applications

Application	Vendor	Product
PI System Suite (Test, Prod, & DR environments)	OSIsoft	Data Archive
Condition Assessment	Microsoft	SQL
AF Builder	OSIsoft	AF SDK
Engineering Dashboards	Microsoft	Sharepoint
	SAP	SAP Business Objects
	OSIsoft	PI Webparts
Operations and Support dashboards	OSIsoft	PI ProcessBook
		PI Coresight
Substation Condition Monitoring & CMMS Health Monitoring	OSIsoft	Asset Framework
		Notifications
		Asset Analytics
Condition Based Maintenance	OSIsoft	RLINK
	SAP	SAP PM
Manual Inspection	OSIsoft CGI CAD	PI Interface for Universal File and Stream
		PI Manual Logger (PI ML)
		Custom CAD web services
Asset Scoring & Algorithms	OSIsoft	PI Advanced Computing Engine (ACE)
External Data Sources	Microsoft	SQL SSIS for Pole Top Solar, GIS, OMS, CAD
		Relay, Doble, Delta-X, Megger, Aspen
EMS Data	OSIsoft	PI to PI Interface
DMS Data	OSIsoft	PI Interface for OPC
Non-Operational Data	OSIsoft	PI Interface for DNP3

# The Future of CMMS

# Future Analytics – Energy Strong

- Determine Load factor for the 4/13/26/69 kV system (better asset utilization):
- Proactive voltage determination:
  - Feeders violating the ANSI voltage limits
  - Our voltage criteria is to operate between 0.95-1.05 p.u. with a goal of operating at 1.05 p.u.:
- Solar Analysis:
  - Voltage impact
  - Transformer LTC impact
  - Capacitor impact
  - Weather impact
- Condition based maintenance reports:
  - LTC movement
  - Power factor vs. available capacitors
- System power analysis factor:
  - Unity power factor
  - Leading power factor
  - Poor power factor
  - Very poor power factor
  - Model validation



# Condition Maintenance and Management System (CMMS) Modernization Project

## COMPANY and GOAL

- 1) PSEG is a New Jersey based Electric and Gas utility based serving over 2.2 million electric customers and 1.8 million gas customers.
- 2) We keep the lights on for NJ



## CHALLENGE

- Aging infrastructure that was obsolete with limited supported by the vendor
- Add data sources (non-operational and manual inspection) and other external data sources
- Production challenges supporting aging platform
- Need to scale assets for a sustainable growth

## SOLUTION

- Upgraded to latest PI System, including High Availability across control centers
- Delivered asset templates and accelerators to support condition monitoring of substation assets
- Enhanced platform security using AD eliminating explicit logins
- Additional data sources for condition assessment such as substation and manual inspection

## RESULTS

- Enabled high availability of data seamlessly to the user at various architecture levels
- Improved CMMS performance and reliability to provide accurate asset health indicators to the planners and operations
- Enabled platform sustainable growth for asset classes using latest PI System technology

# Contact Information

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Manager

Accenture Smart Grid Services



## Questions

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



State your **name & company**

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谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

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