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Turning **insight** into **action**.

The PI System: The Lifeblood at Dynegy's Roseton & Danskammer Plants

Presented by **Biagio Isogna**
Dynegy

Agenda

- Who is Dynegy Northeast Generation?
- PI System Architecture
- How the PI System is used at the Plants
- The Power of PI DataLink (MS Excel add-in)
- Benefits Realized
- Future Plans

Dynegy Northeast Generation

Danskammer Plant:

Roseton Plant:

Dynegy Northeast Generation

- **Roseton Plant:**
  - 2 – 600 MW Units
  - CE tangential Boilers / GE Turbine Generators
  - No.6 Oil / Natural Gas
- **Danskammer Plant:**
  - 2-60 MW - CE tangential Boilers / GE Turbine Generators
    - No.6 Oil / Natural Gas
  - 135 MW - CE tangential Boiler (dual furnace)/ GE Turbine Generators
    - Coal / Natural Gas
  - 235 MW - CE tangential Boiler / GE Turbine Generators
    - Coal / Natural Gas

Business Challenge/Problem Addressed

- Adapt to new dispatch realities
- Optimize the Unit Cycling Operation
- Provide reliable data

OSIsoft Products and Services Employed

- PI Servers (2) 10,000
- PI ProcessBook
- PI DataLink

PI System Architecture

- 2 - 10,000 Tag PI Servers on physical servers
- 4 - Buffers (VMs) connections to Rockwell Processors
- 2 - Connections to Emerson's Ovation DCS – D3 & D4
- 1 - Connection to Matrikon OPC Server (VM)
- 2 - 2,000 Tag PI Servers on VM (VM-Ware system)

  EtaPro System (Roseton - Danskammer)

- PI to PI link to Illinois Regional Office (used for analysis by Corp. Engineer)

Users of the PI System at Roseton and Danskammer Plants

Primary users: Regional VP, Site Manager, Plant Operation Supervisors, Engineers, Shift Supervisors, Shift Chiefs, Operators, Results Techs, Environmental.

Tools: PI ProcessBook, DataLink (MS Excel add-in), EtaPro (application that uses the PI System)

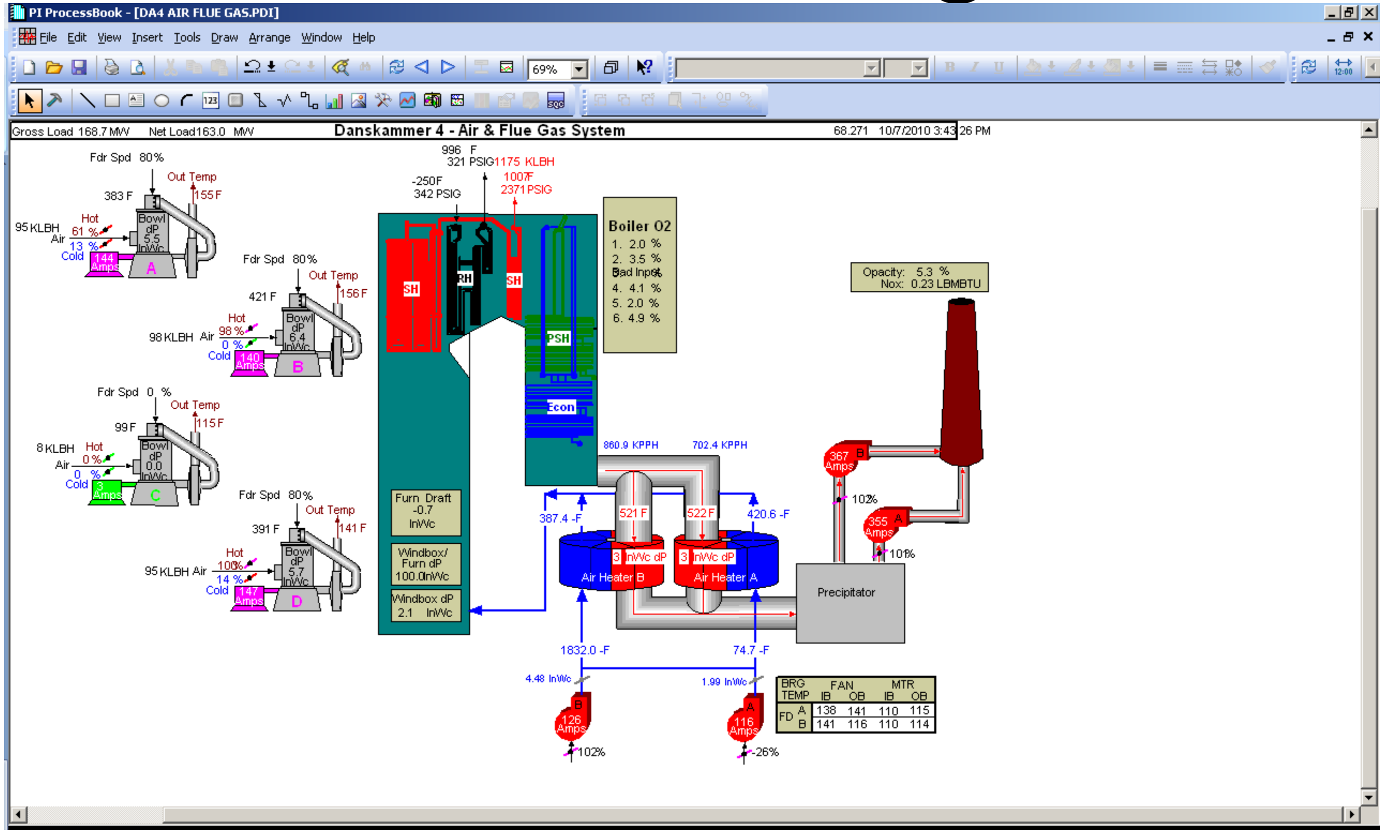
Operation System Information (OSI):

Based on PI ProcessBook, and utilizes basic cycle information. Developed about 4 years ago, some use, but needs a little further development. Mimics DCS data (recent access to remote logins, need to duplicated screens has been reduced).

Uses of the PI System

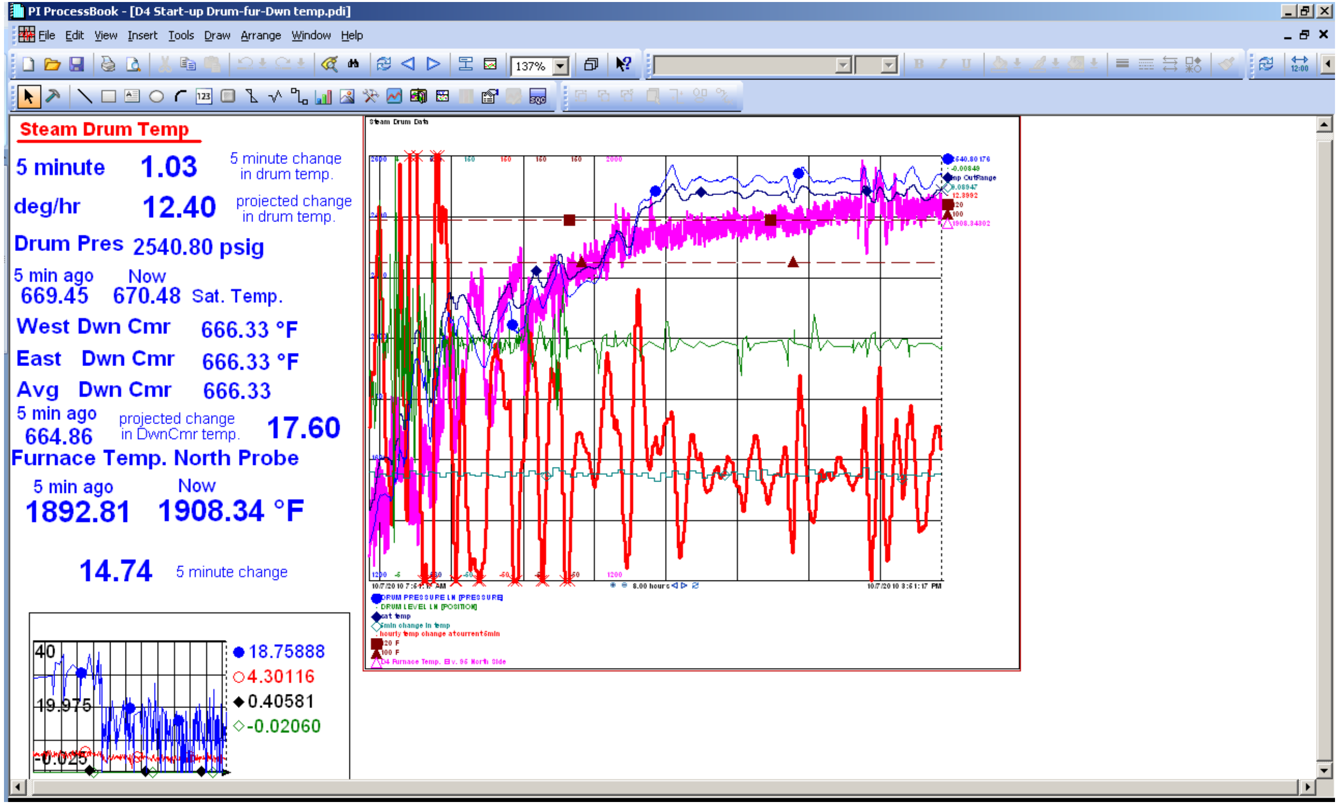
- **Tools**: PI ProcessBook, PI DataLink (MS Excel add-in), EtaPro
- **Engineering Primary Uses:**
- **Tuning Data:**
  - For Both D3 and D4 a complete cycle data spreadsheet was created, and by simply changing dates, and interval , a snapshot of unit's profile is available.
- **Unit Start-up Ramp Rates:**
  - Both spreadsheets (with PI DataLink add-in) and PI ProcessBook are used to guide operators for proper unit temperature ramp rates, for the boiler and turbine.
- **DCS Control curve – testing and tuning:**
  - Equipment Specific Test spreadsheets are created to collect and analyze the data; and curve fit the graphs to create the DCS control inputs.

Environmental Monitoring

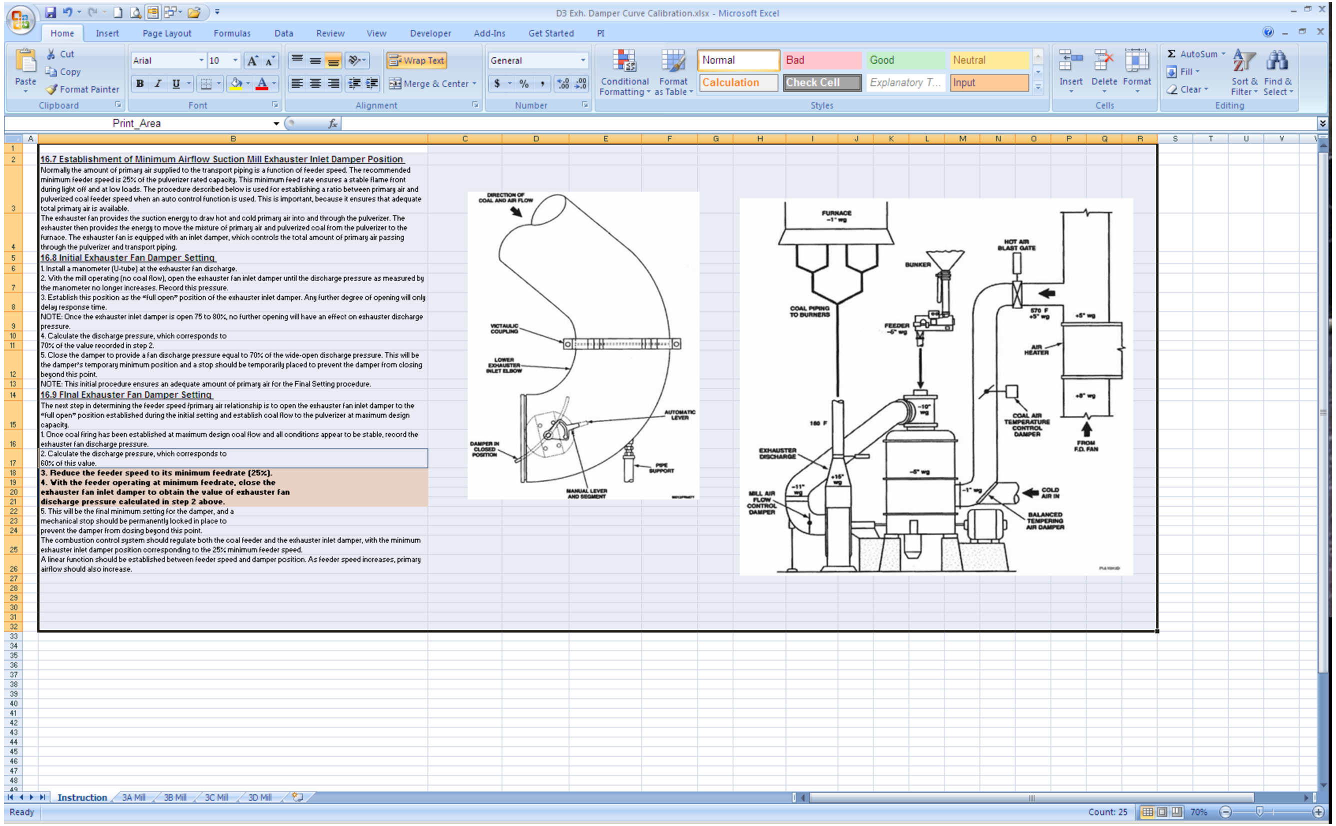


BRG TEMP		FAN IB	FAN OB	MTR IB	MTR OB
FD	A	138	141	110	115
	B	141	116	110	114

Monitoring Steam Drum Temps



DCS Curve Development



16.7 Establishment of Minimum Airflow Suction Mill Exhauster Inlet Damper Position

Normally the amount of primary air supplied to the transport piping is a function of feeder speed. The recommended minimum feeder speed is 25% of the pulverizer rated capacity. This minimum feed rate ensures a stable flame front during light off and at low loads. The procedure described below is used for establishing a ratio between primary air and pulverized coal feeder speed when an auto control function is used. This is important, because it ensures that adequate total primary air is available.

The exhauster fan provides the suction energy to draw hot and cold primary air into and through the pulverizer. The exhauster then provides the energy to move the mixture of primary air and pulverized coal from the pulverizer to the furnace. The exhauster fan is equipped with an inlet damper, which controls the total amount of primary air passing through the pulverizer and transport piping.

16.8 Initial Exhauster Fan Damper Setting

1. Install a manometer (U-tube) at the exhauster fan discharge.
2. With the mill operating (no coal flow), open the exhauster fan inlet damper until the discharge pressure as measured by the manometer no longer increases. Record this pressure.
3. Establish this position as the "full open" position of the exhauster inlet damper. Any further degree of opening will only delay response time.

NOTE: Once the exhauster inlet damper is open 75 to 80%, no further opening will have an effect on exhauster discharge pressure.

4. Calculate the discharge pressure, which corresponds to 70% of the value recorded in step 2.
5. Close the damper to provide a fan discharge pressure equal to 70% of the wide-open discharge pressure. This will be the damper's temporary minimum position and a stop should be temporarily placed to prevent the damper from closing beyond this point.

NOTE: This initial procedure ensures an adequate amount of primary air for the Final Setting procedure.

16.9 Final Exhauster Fan Damper Setting

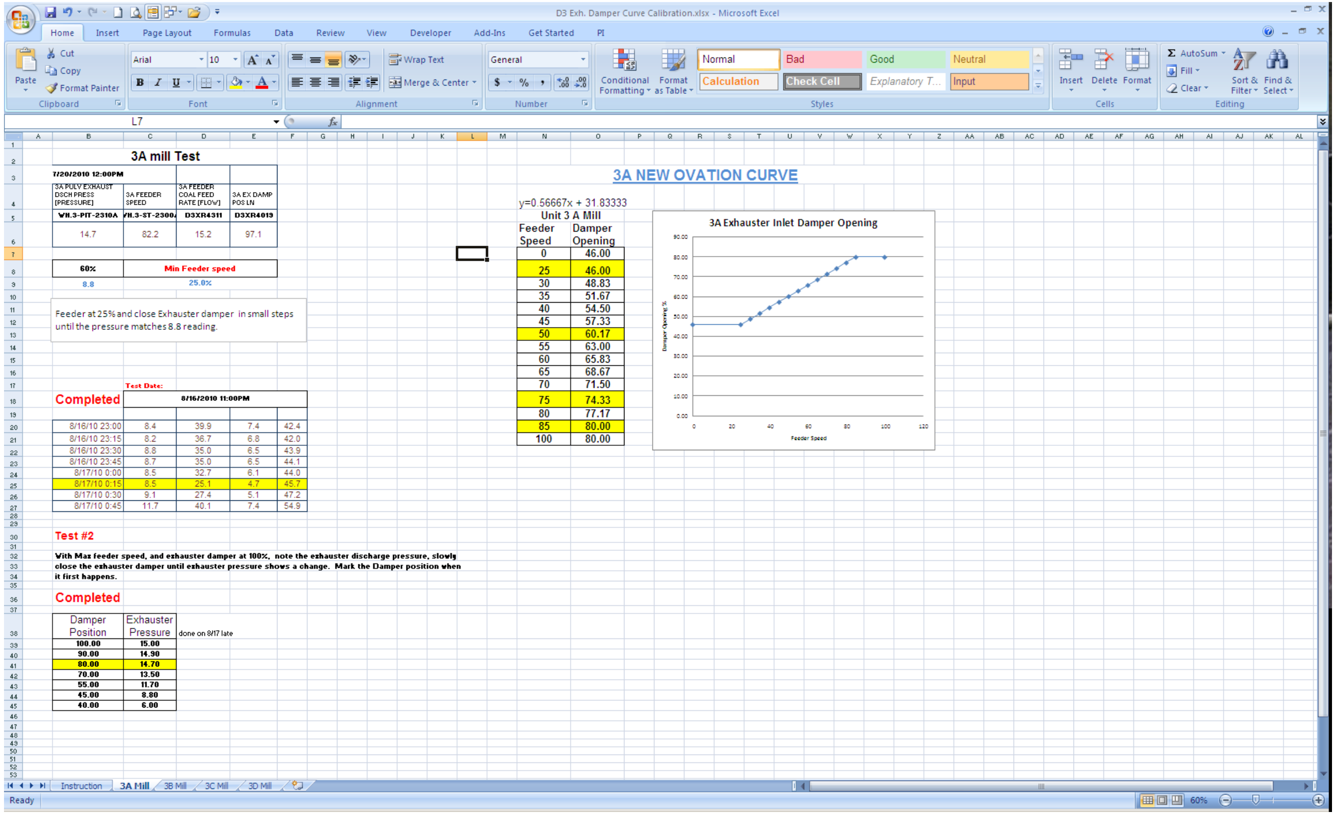
The next step in determining the feeder speed /primary air relationship is to open the exhauster fan inlet damper to the "full open" position established during the initial setting and establish coal flow to the pulverizer at maximum design capacity.

1. Once coal firing has been established at maximum design coal flow and all conditions appear to be stable, record the exhauster fan discharge pressure.
2. Calculate the discharge pressure, which corresponds to 60% of this value.
3. **Reduce the feeder speed to its minimum feedrate (25%).**
4. **With the feeder operating at minimum feedrate, close the exhauster fan inlet damper to obtain the value of exhauster fan discharge pressure calculated in step 2 above.**
5. This will be the final minimum setting for the damper, and a mechanical stop should be permanently locked in place to prevent the damper from dosing beyond this point.

The combustion control system should regulate both the coal feeder and the exhauster inlet damper, with the minimum exhauster inlet damper position corresponding to the 25% minimum feeder speed.

A linear function should be established between feeder speed and damper position. As feeder speed increases, primary airflow should also increase.

DCS Curve Development



D3 Exh. Damper Curve Calibration.xlsx - Microsoft Excel

3A mill Test

7/20/2010 12:00PM			
3A PULV EXHAUST DSCH PRESS [PRESSURE]	3A FEEDER SPEED	3A FEEDER COAL FEED RATE [FLOW]	3A EX DAMP POS LN
WH.3-PIT-2310A	WH.3-ST-2300A	D3XR4311	D3XR4019
14.7	82.2	15.2	97.1

60%	Min Feeder speed
8.8	25.0%

Feeder at 25% and close Exhauster damper in small steps until the pressure matches 8.8 reading.

Test Date:

Completed	8/16/2010 11:00PM			
8/16/10 23:00	8.4	39.9	7.4	42.4
8/16/10 23:15	8.2	36.7	6.8	42.0
8/16/10 23:30	8.8	35.0	6.5	43.9
8/16/10 23:45	8.7	35.0	6.5	44.1
8/17/10 0:00	8.5	32.7	6.1	44.0
8/17/10 0:15	8.5	25.1	4.7	45.7
8/17/10 0:30	9.1	27.4	5.1	47.2
8/17/10 0:45	11.7	40.1	7.4	54.9

Test #2

With Max feeder speed, and exhauster damper at 100%, note the exhauster discharge pressure, slowly close the exhauster damper until exhauster pressure shows a change. Mark the Damper position when it first happens.

Completed

Damper Position	Exhauster Pressure
100.00	15.00
90.00	14.90
80.00	14.70
70.00	13.50
55.00	11.70
45.00	8.80
40.00	6.00

done on 8/17 late

3A NEW OVATION CURVE

y=0.56667x + 31.83333

Unit 3 A Mill

Feeder Speed	Damper Opening
0	46.00
25	46.00
30	48.83
35	51.67
40	54.50
45	57.33
50	60.17
55	63.00
60	65.83
65	68.67
70	71.50
75	74.33
80	77.17
85	80.00
100	80.00

Unit’s Tuning Data Snapshot

Danskammer3 Boiler Tuning-1.xls [Compatibility Mode] - Microsoft Excel

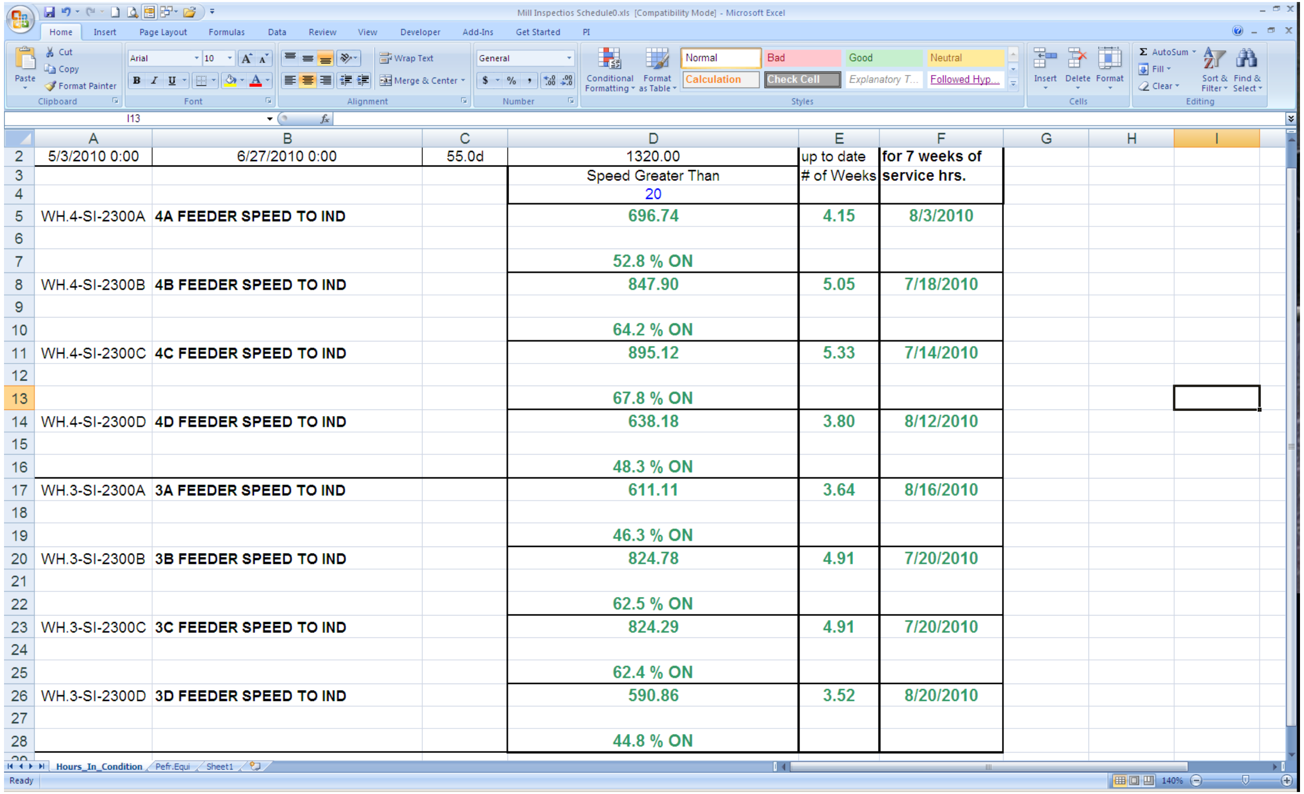
A6 | Period

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**DYNEGY**														
2	**Danskammer 3**														
3	**TEST**				**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**	**Averages**
4	**Comments:**	(now)			Averages	Averages	Averages	Averages	Averages	Averages	Averages	Averages	Averages	Averages	Averages
5	Date	###########		--> change the date just here and rest will update. ---->>>	2/22/10 8:00	2/22/10 8:30	2/22/10 9:00	2/22/10 9:30	2/22/10 10:00	2/22/10 10:30	2/22/10 11:00	2/22/10 11:30	2/22/10 12:00	2/22/10 12:30	2/22/10 13:00
6	Period				15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
7															
8	MW	MW													
9	MW - GROSS	MW	D3AI0701	D3 GENERATOR LOAD [POWER]	138.0	138.1	137.9	137.9	137.8	137.8	137.6	137.9	137.7	137.7	137.6
10	MW - NET	MW	D3XE2901	D3 NET GENERATION - JEM METERS [POWER]	129.2	129.3	129.1	129.1	128.9	129.1	128.9	129.0	128.7	128.8	128.8
11	THROTTLE PRESSURE MEAS	PSIG	D3XR3801	MAIN STM PRESS LN [PRESSURE]											
12	1ST STAGE PRESSURE	PSIG	D3XR0602	FIRST STAGE PRESS LN [PRESSURE]	1,876.6	1,875.9	1,876.5	1,876.0	1,875.8	1,876.1	1,876.3	1,878.3	1,877.1	1,877.0	1,874.9
13	STEAM FLOW	KLBHR	D3XR3803	MAIN STM FLOW LN [FLOW]	1,062.7	1,062.1	1,063.6	1,062.5	1,063.1	1,062.9	1,063.6	1,067.7	1,067.8	1,067.8	1,065.4
14	FEEDWATER FLOW	KLBHR	D3XR3607	FEEDWATER FLOW LN [FLOW]	1,028.7	1,027.9	1,029.9	1,028.3	1,028.4	1,027.8	1,028.0	1,029.4	1,030.7	1,032.0	1,033.2
15	TOTAL FUEL FLOW	KLBHR	D3XF4001	NET COAL BURNED UNIT 3 [FLOW]	50.9	50.9	50.7	50.7	50.7	50.6	50.6	50.1	50.0	50.0	50.1
16	TOTAL AIR FLOW	KLBHR	D3XR1404	AIR FLOW LN [FLOW]	952.6	957.1	953.6	953.0	955.1	951.5	954.0	982.7	984.6	985.8	988.7
17															
18	SH OUTLET TEMP A	DEGF	D3AI0101	MAIN STEAM TEMP [TEMP]	959.2	958.9	957.4	958.3	957.2	957.3	956.4	951.7	951.3	950.2	952.2
19															
20	SH LOW TEMP OUTLET	DEGF	D3AI4140	PRI SPHTR A OUTLET B4 DESUP TEMP [TEMP]	799.6	799.6	799.3	799.1	798.8	798.5	798.3	798.3	798.6	798.9	799.3
21	SH LOW TEMP OUTLET	DEGF	D3AI4141	PRI SPHTR B OUTLET B4 DESUP TEMP [TEMP]	811.0	811.1	811.2	811.3	811.4	811.5	811.6	812.0	812.9	813.7	814.6
22															
23															
24	FURNACE TEMP (NORTH)	DEGF	D3AI5010	D3 North furnace temp probe [TEMP]	2,031.6	2,033.1	2,033.8	2,027.7	2,029.2	2,030.4	2,034.9	2,009.4	2,009.9	2,010.2	2,009.6
25	FURNACE TEMP (SOUTH)	DEGF	D3AI5011	D3 South furnace temp probe [TEMP]	1,642.2	1,652.4	1,659.7	1,666.9	1,659.5	1,786.7	1,974.0	1,927.6	1,919.4	1,919.2	1,944.8
26															
27															
28	SH SPRAY VALVE	%	WH.3-TY-430A-POS	3A NORTH SH SPRAY VLV POS FB	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9
29	SH SPRAY VALVE	%	WH.3-TY-430B-POS	3B SOUTH SH SPRAY VLV POS FB	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
30	SH SPRAY PRESSURE	PSIG	D3AI1603	FEEDWATER PRESS [PRESSURE]	2,727.4	2,726.2	2,727.2	2,726.4	2,725.9	2,726.6	2,726.3	2,730.4	2,728.6	2,728.4	2,725.4
31	SH SPRAY FLOW	KLBH	D3XR4201	SUPERHEAT SPRAY FLOW LN [FLOW]	0.2	0.2	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0
32															
33	BOILER DRUM PRESSURE	PSIG	D3XR1401	BOILER DRUM PRESSURE LN [PRESSURE]	2,533.9	2,532.2	2,532.9	2,532.3	2,531.6	2,532.5	2,532.2	2,535.5	2,533.2	2,533.0	2,530.5
34	BCP DIFF PRESS A	PSIG	D3XR1609	BCP A DIFF PRESS LN [PRESSURE]	35.0	35.0	35.0	34.9	35.0	35.0	35.0	34.9	34.9	34.9	34.9
35	BCP DIFF PRESS B	PSIG	D3XR1610	BCP B DIFF PRESS LN [PRESSURE]	33.2	33.2	33.2	33.2	33.2	33.2	33.1	33.1	33.2	33.2	33.2
36	FW > ECON INLET TEMP	DEGF	D3AI3601	FW TO ECON TEMP [TEMP]	511.0	510.9	510.9	510.9	510.8	510.9	510.8	510.8	510.6	510.6	510.6
37	FW> ECON OUTLET	DEGF	D3AI4132	ECONOMIZER A OUTLET TEMP [TEMP]	560.2	560.2	560.3	560.3	560.3	560.3	560.3	560.4	560.6	560.8	561.0
38	FW> ECON OUTLET	DEGF	D3AI4133	ECONOMIZER B OUTLET TEMP [TEMP]	457.7	457.7	457.8	457.8	457.9	458.0	458.0	458.1	458.3	458.5	458.7
39	DRUM LEVEL	IN NWL	D3XR1403	DRUM LEVEL LN [POSITION]	-0.2	0.0	-0.2	0.0	0.0	0.0	-0.1	-0.3	0.0	-0.1	-0.1
40															
41	COLD RH DESP OUT TEMP A	DEGF	D3AI4142	COLD REHEAT A TEMP [TEMP]	592.1	591.9	590.7	591.4	590.4	590.5	589.5	586.4	585.1	584.7	586.0
42	COLD RH DESP OUT TEMP B	DEGF	D3AI4143	COLD REHEAT B TEMP [TEMP]	591.8	591.7	590.5	591.0	590.2	590.3	589.6	586.3	584.8	584.5	585.7

D3 - BOILER Tunning

Ready

Mill's Inspection Schedule



	A	B	C	D	E	F
2	5/3/2010 0:00	6/27/2010 0:00	55.0d	1320.00	up to date	for 7 weeks of
3				Speed Greater Than	# of Weeks	service hrs.
4				20		
5	WH.4-SI-2300A	**4A FEEDER SPEED TO IND**		696.74	4.15	8/3/2010
6						
7				52.8 % ON		
8	WH.4-SI-2300B	**4B FEEDER SPEED TO IND**		847.90	5.05	7/18/2010
9						
10				64.2 % ON		
11	WH.4-SI-2300C	**4C FEEDER SPEED TO IND**		895.12	5.33	7/14/2010
12						
13				67.8 % ON		
14	WH.4-SI-2300D	**4D FEEDER SPEED TO IND**		638.18	3.80	8/12/2010
15						
16				48.3 % ON		
17	WH.3-SI-2300A	**3A FEEDER SPEED TO IND**		611.11	3.64	8/16/2010
18						
19				46.3 % ON		
20	WH.3-SI-2300B	**3B FEEDER SPEED TO IND**		824.78	4.91	7/20/2010
21						
22				62.5 % ON		
23	WH.3-SI-2300C	**3C FEEDER SPEED TO IND**		824.29	4.91	7/20/2010
24						
25				62.4 % ON		
26	WH.3-SI-2300D	**3D FEEDER SPEED TO IND**		590.86	3.52	8/20/2010
27						
28				44.8 % ON		

Main Steam Stop By-Pass VV Service Hrs

Stop VV -by Pass.xlsx - Microsoft Excel

D16 =D11-D14

	B	C	D	E
1	Report End Date	Interval	Period Hrs	
2	9/29/2010 0:00	271.0d	6504.00	
3			VV position Greater Than	VV position Greater Than
4			31	60
5	D3BnRack1.Slot_9_STOP_VALVE_BYPASS_Pos.Direct_Amplitude		4510.3	
6				
7				
8	D3BnRack1.Slot_9_STOP_VALVE_BYPASS_Pos.Direct_Amplitude		4396.1	
9				
10			114.2	
11	D4 Main Steam VV by-pass VV position.		4195.7	
12				
13				
14	D4 Main Steam VV by-pass VV position.		4103.5	
15				
16			92.2	

Hours_In_Condition / Past data D3 / Past data D4

Major Motors Starts/Stops and Service Hrs

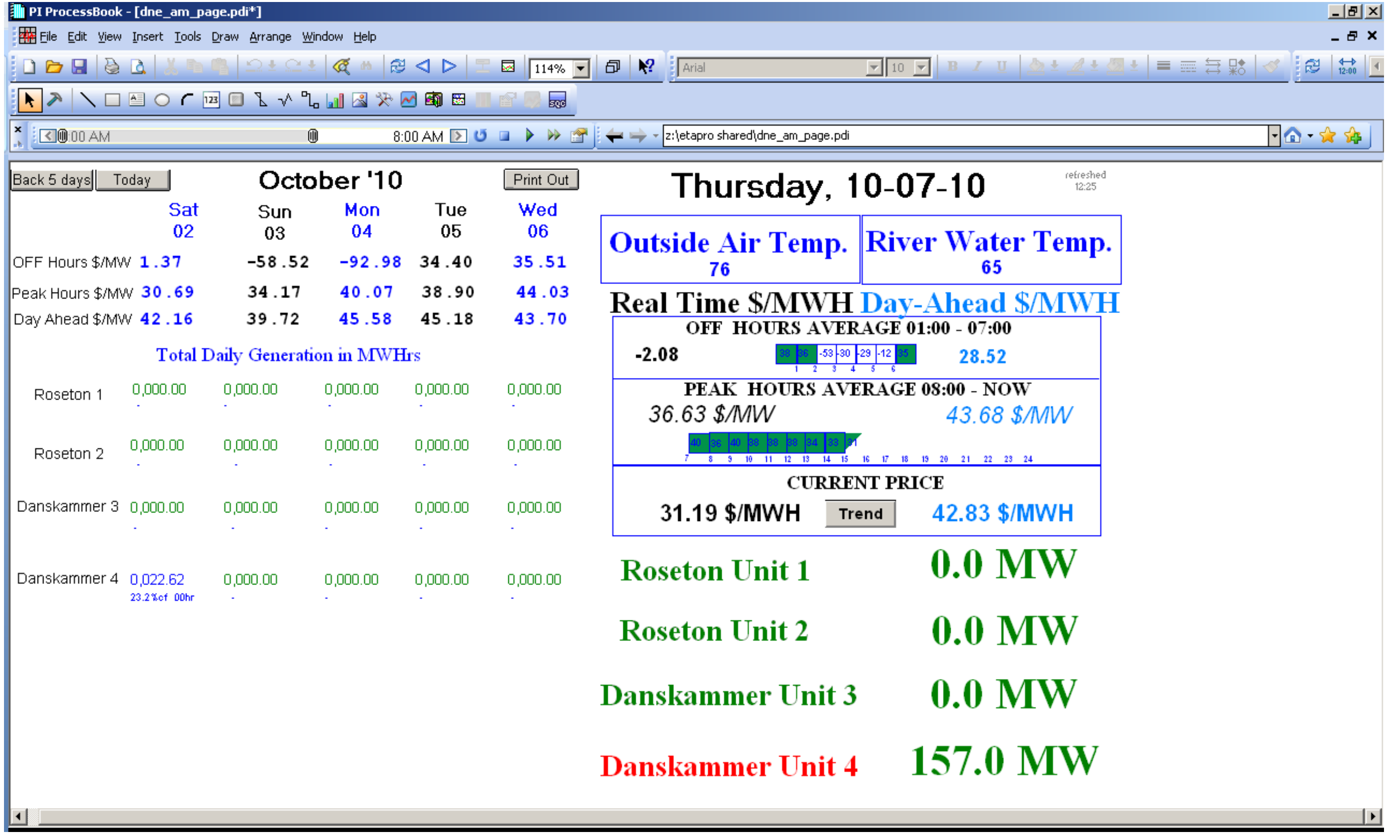
Year 2010 — Number of Starts / Service Hours

Equipment		January		February		March		April		May		June		July		August		September		October		November		December	
ID FAN A	D4DE0301	2	724.3	0	671.9	1	385.1	0	.0	7	475.0	3	645.2	7	678.7	2	705.0	20	525.5	4	361.6	3	573.8	0	744.0
ID FAN B	D4DE0302	1	723.7	0	671.9	1	384.7	0	.0	7	474.0	6	644.2	3	677.1	12	308.7	16	196.5	6	383.3	3	148.0	0	.0
FD FAN A	D4DE0303	2	724.3	0	671.9	1	385.0	0	.0	7	474.4	3	645.1	5	678.3	2	704.9	15	523.4	4	361.4	3	573.5	0	744.0
FD FAN B	D4DE0304	2	723.6	0	671.9	1	384.6	0	.0	7	473.7	4	643.9	3	677.0	7	698.5	16	523.0	4	360.5	3	572.9	0	744.0
SERVICE WATER PUMP A	D4DI1606	0	.0	0	.0	2	307.5	0	.0	2	177.3	1	69.7	3	699.0	2	734.6	5	545.7	4	302.3	0	695.4	0	.0
SERVICE WATER PUMP B	D4DI1607	0	743.8	0	671.8	0	131.1	0	.0	32	439.5	17	697.9	2	725.0	18	680.8	14	701.7	132	501.2	9	60.4	0	744.0
COND PUMP A	D4DE1601	5	724.7	15	618.0	8	497.8	0	.0	18	533.6	24	557.4	20	561.0	21	551.0	12	633.3	11	308.1	16	544.0	24	648.8
COND PUMP B	D4DE1602	21	652.3	13	635.4	15	287.7	0	.0	8	459.7	12	535.0	7	712.1	11	631.3	14	435.3	9	395.7	12	489.0	7	699.0
CIRC WATER PMP A	D4DE1603	1	684.2	0	671.9	3	374.2	2	2.9	3	540.7	2	649.5	11	646.3	7	676.6	5	522.6	3	535.6	4	597.3	0	744.0
CIRC WATER PMP B	D4DE1604	0	743.9	0	671.9	2	428.0	2	1.6	7	502.2	3	678.9	0	743.5	8	723.0	4	379.7	11	239.6	11	609.5	1	737.9
CIRC WATER PMP C	D4DE1605	1	24.7	0	.0	0	.0	3	1.2	0	.0	6	126.5	9	575.4	8	670.7	19	406.4	1	33.4	0	.0	0	.0
4A BOILER CIRC PUMP	D4DI1613	11	.0	0	.0	0	.0	0	.0	0	.0	0	.0	0	.0	0	.0	0	.0	5	321.8	3	661.0	0	744.0
4B BOILER CIRC PUMP	D4DI1614	2	724.4	0	671.9	3	382.9	2	.0	8	519.8	1	681.3	2	706.3	2	708.0	2	633.5	5	385.1	2	661.0	0	744.0
PULVERIZER 4A	D4DI4001	21	743.9	21	671.9	20	428.0	0	1.6	24	502.2	40	678.9	24	743.5	38	723.0	27	379.7	18	239.6	34	609.5	33	737.9
PULVERIZER 4B	D4DI4002	1	24.7	0	.0	8	.0	0	1.2	9	.0	6	126.5	4	575.4	20	670.7	18	406.4	19	33.4	22	.0	2	.0
PULVERIZER 4C	D4DI4003	2	.0	1	.0	5	.0	0	.0	9	.0	8	.0	3	.0	17	.0	15	.0	7	321.8	14	661.0	2	744.0
PULVERIZER 4D	D4DI4004	9	724.4	15	671.9	13	382.9	0	.0	15	519.8	32	681.3	31	706.3	35	708.0	25	633.5	18	385.1	28	661.0	41	744.0

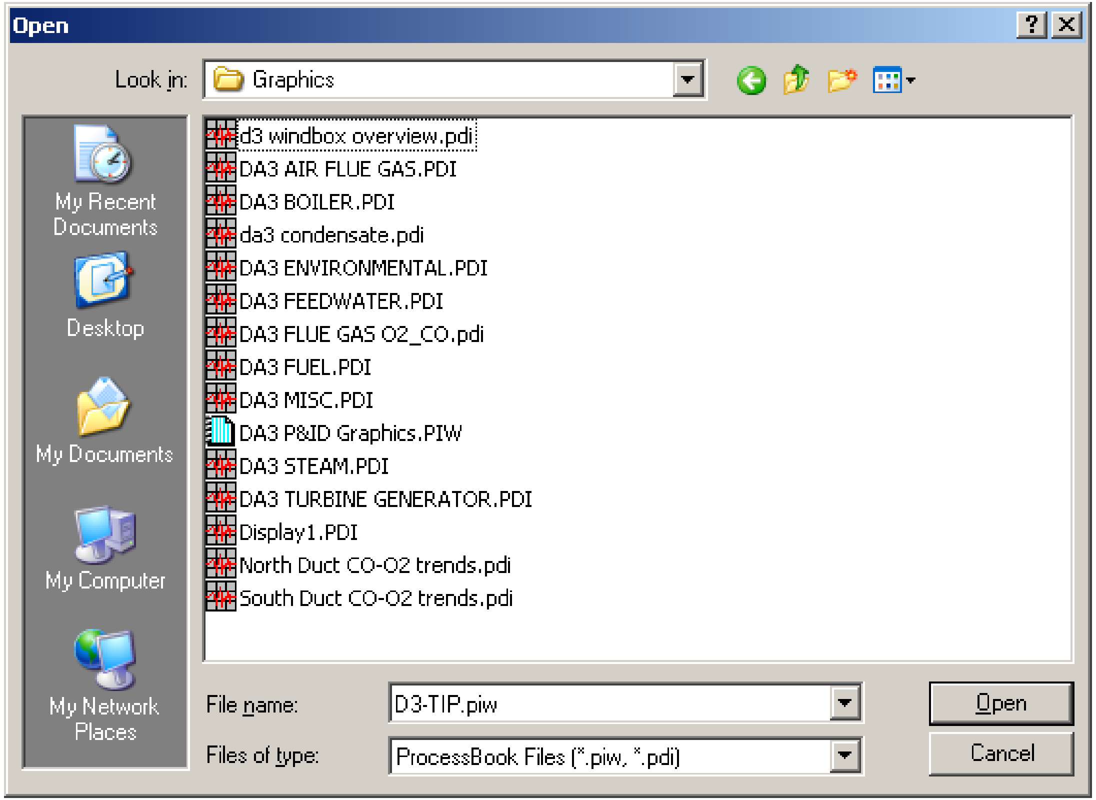
2010	D4DE0301	D3DE0303
	D4DE0302	D3DE0304
	D4DE0303	D3DE0301
	D4DE0304	D3DE0302
	D4DI1606	D3DE1606
	D4DI1607	D3DE1607
	D4DE1601	D3DE1611
	D4DE1602	D3DE1612
	D4DE1603	D3DE1613
	D4DE1604	D3DE1614
	D4DE1605	D3DE1601
	D4DI1613	D3DE1602
	D4DI1614	D3DE1605
	D4DI4001	D3DI4001
	D4DI4002	D3DI4002
	D4DI4003	D3DI4003
	D4DI4004	D3DI4004

Update Now

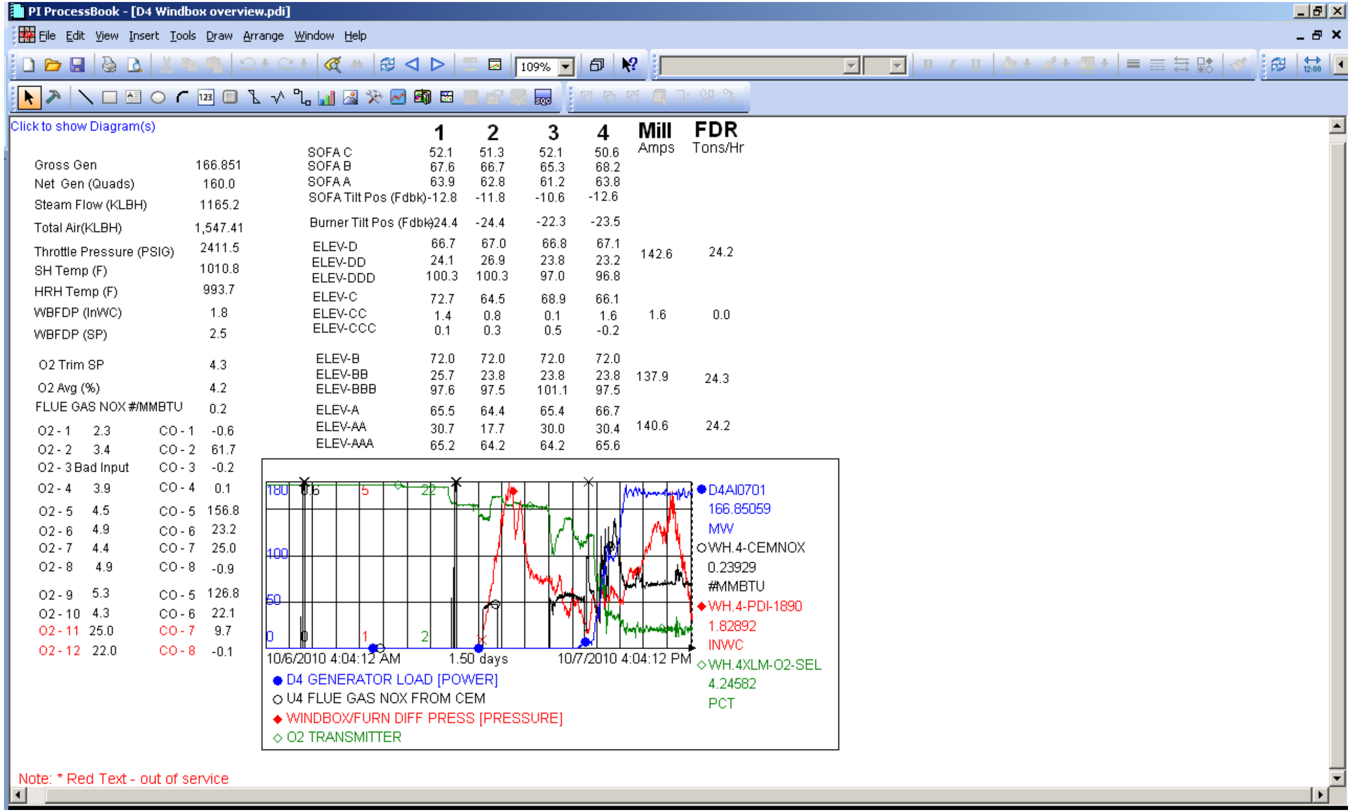
NYISO Daily Review



Shared Directory

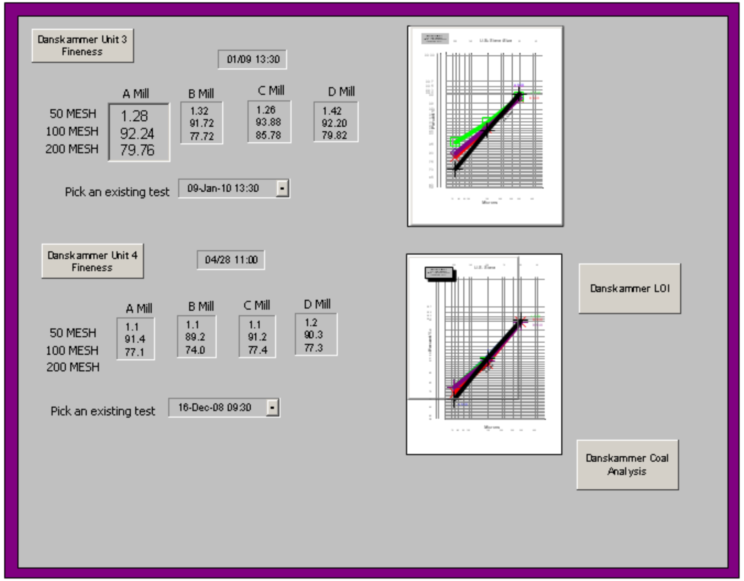


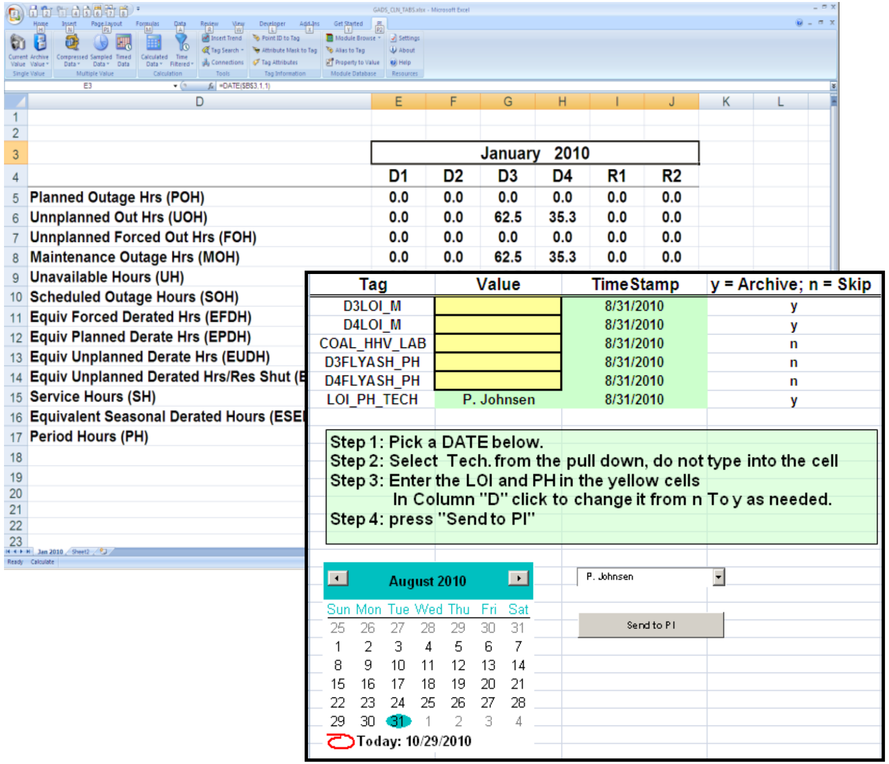
Monitoring of the Windbox



Additional Uses of the PI System

- GADS Monthly results go into the PI System
- Daily Chemistry Test
- Coal Testing





Benefits of having the PI System

Access to DATA!

- Real-time analysis of Unit condition
- Management's ability to see details of events
- Real-time equipment health assessment
- Operators can see what management is looking at

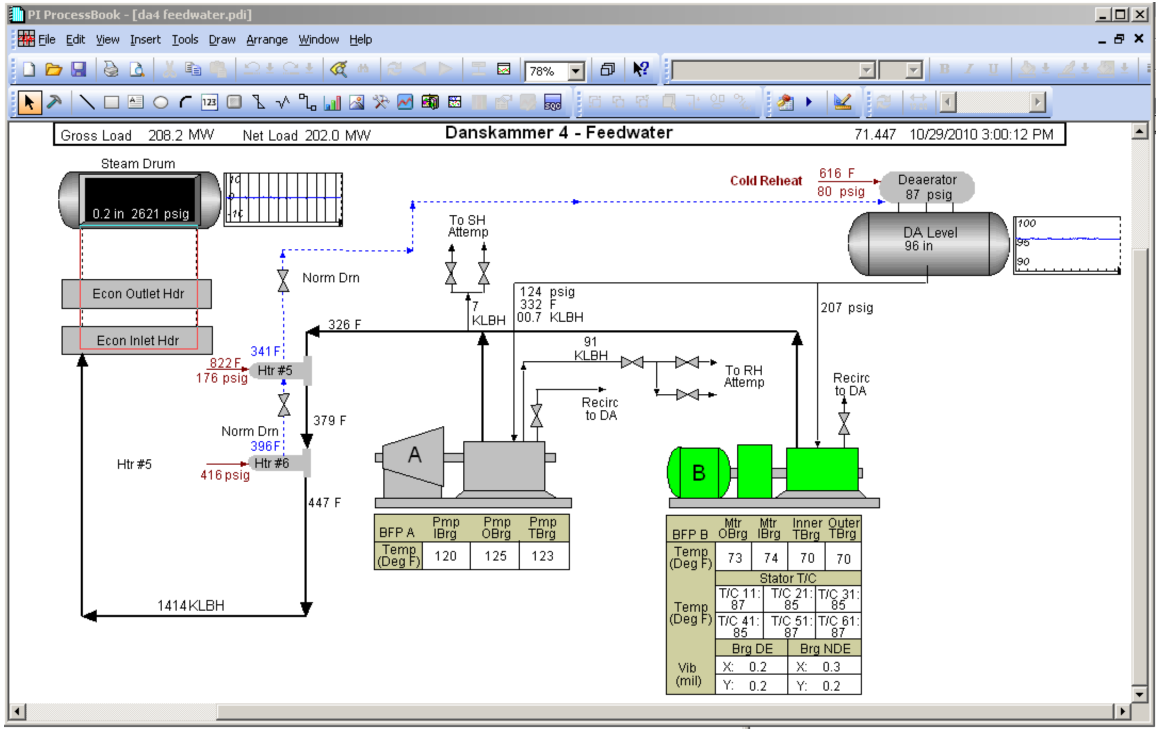
Tangible Benefits

- Reduction of Environmental impact : NOX, SOX, Circulating water Outlet flow/temperature

  (today's focus…….)
- Consistent, repeatable start-ups. The ability to review and analyze unit start-ups (Tangible is actual cost of fuel and NYISO cost/penalty of on-time commitment).
- Real-time Unit/Equipment Performance
- Able to be more opportunistic in maintenance activities

Intangible Benefits

- Great learning tool for new engineers and operators



Future Plans / Next Steps

- Getting more manual data in to PI System (via PI Manual Logger) to reduce the number of spreadsheet links
- Better Organization of “shared” folders
- Increase use of PI Batch for optimizing unit start-ups

Turning **insight** into **action**.

Thank you