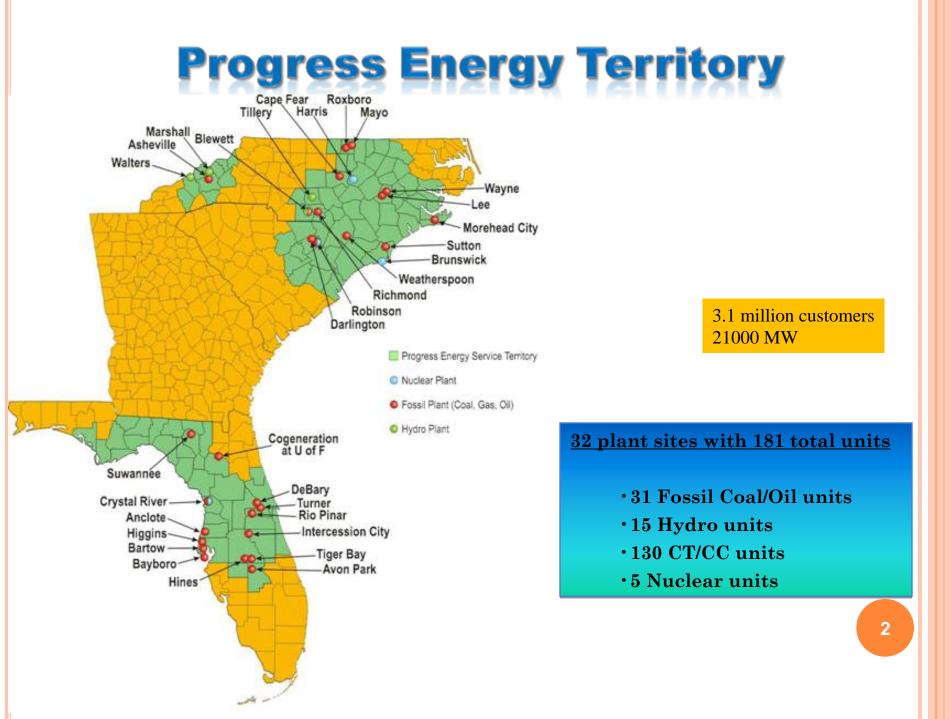


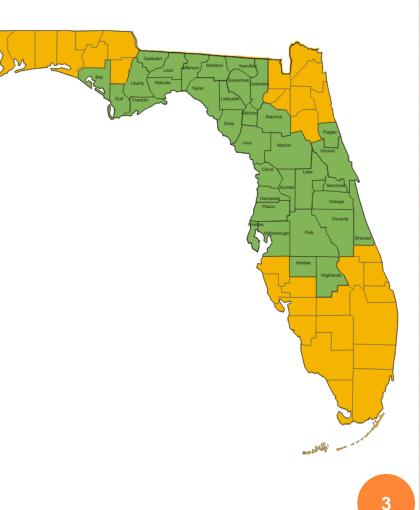
Scientech 2009 Symposium January 13-15, 2009

> PROGRESS ENERGY M & D CENTER



Progress Energy Florida

- More than 1.7 million customers in 35 counties
- Over 100 years of service
- 4,300 employees
- More than 9,000 megawatts of generation
- 5,000-mile transmission and 40,000-mile distribution network
- 14 generating plant sites (64 units)

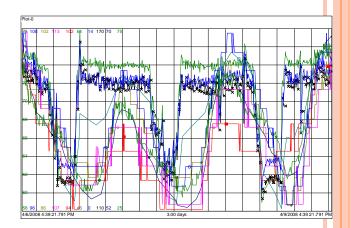


M&D Center



Fleet Wide Pattern recognition monitoring for Fossil, CT, & CC

Nuclear & Transmission interested



Pattern Recognition

- 3 full time employees with IT support
 - Over 3000 Models running

Pattern Recognition

- Initially the focus of the M&D Center was early detection of reliability issues with rotating equipment
 - CT group has been monitoring for 5 years
 Fossil steam plants is 1 ½ years old
- Most of 2008 was spent building our own models & training our own data
- During the latter part of 2008 we focus more in monitor and maintaining our models
- Goal for 2009 is to expand the capability of the PdP models to include key thermal performance indicators

Avoided 2008 Pattern Recognition Finds <u>Costs</u> **Fossil Finds** 101,000 Auxiliary transformer cooling fan failure 32,285 Air Heater Hot End bearing oil pump failure 17,504 Lube Oil heat exchanger pluggage 11,760 Air Heater Ammonia Bisulphate differential ramp 18,521 XO Feedwater heater extraction supply valve failure 8,060 Plugged circ water pump cooler 2,613 Air Heater guide bearing cooling fan failure 1,931

Air Heater hot end bearing oil circulator filter plugged

193,674 **Total Fossil**

CT Finds

| Generator J strap (gooseneck) failure | 1,993,800 |
|---|-----------|
| Exhaust flex seal deterioration | 42,100 |
| Performance Instrumentation malfunction | 33,540 |
| Steam Turbine oil deflector rub | 32,391 |
| Failed lube oil cooling valve | 7,251 |
| • | |

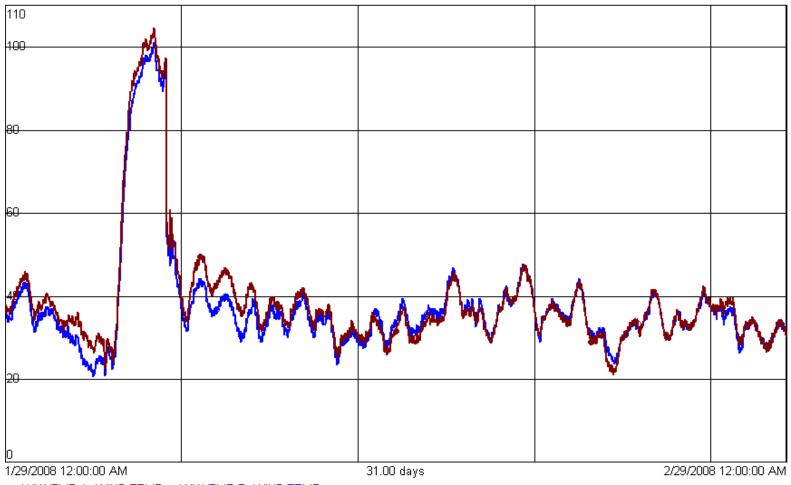
2,109,082 **Total CT**

Total = \$2,302,756

Auxiliary Transformer avoided costs = \$101,000

| 🖳 R*TIME Data Viev | wer - [point_summary-p.dis] | | | | | | | | | _ 8 > |
|--|---|--------------------------|-----------|------------|----------|----------------|------------------------------------|----------------------------|------------|----------|
| 🧾 <u>F</u> ile <u>E</u> dit <u>V</u> iew | <u>D</u> isplay Viewer <u>S</u> ecurity <u>W</u> indow <u>H</u> elp | 2 | | | | | | | | _ 8 > |
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| | BAD: 8 Health | PdP POINT S Roxboro l | | Y | | | | | | |
| UNIT | rox3 FF | REQUENCY 300 seconds | TOTA | POINTS 8 | 4-Pt T | rend | | atus Legeno BNORMAL - N | | INACTIVE |
| MODEL | 3ATRANp Vi | Aldatn Paramtr 0.90 | PNTS in | n ALARM 0 | GROU | | NS | D-4 | | |
| 3 AUX TRANS | CL | JTOFF POINT TE-343DA | V/ | ALUE 59.60 | 6 | N 11. | | Dat | a Miner | |
| CATEGORY | OK | ESCRIPTION AUX XEMR A V | wind temp | | RADIA | | - | ASSE | SSMEN | п |
| MODEL STATUS | | JTOFF: HIGH LIMIT 20 | 0. LO | W LIMIT 0. | _ | _ | | AUU | - O O MILI | |
| MODEL HEALTH | 0.993 Assign Category | ALARMS: X out of Y | X = 18 | 3 Y = 20 | | arm owledge | Alarm on: <mark>Residual</mark> | | Page | e 1 of 1 |
| INPUT POINT | DESCRIPTION | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG ACT | r trend |
| TE-343CA | STRT XFMR A WIND TEMP | DEG C | 62.000 | 61.692 | 0.388 | 0.308 | 10.000 | -10.000 | Yes | |
| TE-343CB | STRT XEMR B WIND TEMP | DEG C | 50,400 | 49.887 | 0.018 | 0.013 | 10.000 | -10.000 | Yes | - |
| TE-343DA | AUX XEMR A WIND TEMP | DEG C | 59.600 | 56.719 | 2.439 | 2.081 | 10.000 | -10.000 | Yes | 1 |
| TE-343DB | AUX XEMR B WIND TEMP | DEG C | 49.100 | 51.619 | 3.611 | -3.019 | 10.000 | -10.000 | Yes | |
| TT-343AA | 3A STUP XFMR TOP OIL TEMP | DEGC | 37.844 | 37.469 | 0.487 | 0.375 | 0.000 | 0.000 | Yes | 1 |
| TT-343AAX | 3A STUP XFMR X-WIND TEMP | DEGC | 37.612 | 37.356 | 0.218 | 0.171 | 10.000 | -10.000 | Yes | |
| TT-343AAY | 3A STUP XFMR Y-WIND TEMP | DEGC | 37.173 | 36.979 | 0.246 | 0.194 | 10.000 | -10.000 | Yes | 1 |
| TE-344B | AMBIENT AIR | DEG F | 66.279 | 67.470 | 0.644 | 1.152 | 15.000 | -15.000 | Yes | |
| | | | | | | | | | | |

Auxiliary Transformer avoided costs = \$101,000



AUX XEMR A WIND TEMP OAUX XEMR B WIND TEMP

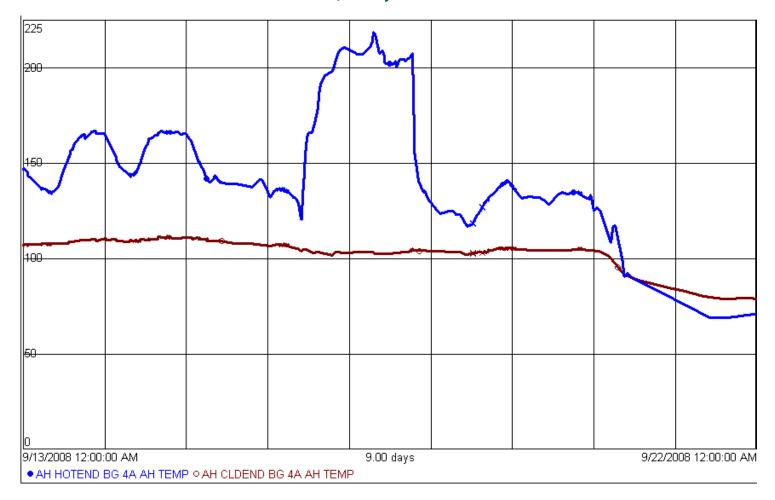
Air Heater Hot End Bearing

avoided costs = \$32,285

| 🛄 R*TIME Data Viewer · | - [point_summary-p.dis] | • | | | | | | | | _ 8 × |
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| | DIFF D D point | _summary-p 🔻 🤋 🍂 | point_su | mmary- | | | | | | |
| 10-DEC-08 BAD 8:26:48 IVM | | PdP POINT S Roxboro I | | Y | | | | | | |
| | · · · · | FREQUENCY 300 seconds Valdatn Paramtr 0.90 | | L POINTS 9 | | - t | 4 AE | atus Legen NORMAL | | INACTIVE |
| MODEL 42 4A AIR HEATER | ажнткр | CUTOFF POINT TE-433AC-AV | | ALUE 661.6 | GROU | | NS | Dat | ta Mine | r i |
| CATEGORY | n | DESCRIPTION AVG GAS IN TE | | | RACE | | - | ASS | ESSMEN | п |
| | NORMAL 0.994 Assign Category | CUTOFF: HIGH LIMIT 400 ALARMS: X out of Y | x = 18 | W LIMIT 53 } Y = 2 | A | owiedze | Alarm on: <mark>Residual</mark> | | Pag | e 1 of 1 |
| INPUT POINT | DESCRIPTION | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG AC | t trend |
| 420ATOTAIRFLOW | 4A TOTAL AIRFLOW | % | 71.401 | 73.946 | 1.804 | -2.040 | 0.000 | 0.000 | Yes | - |
| TE-433AC-AVG | AVG GAS IN TEMP-4A AH | DEG F | 661.605 | 660.318 | 0.705 | 2.033 | 10.000 | -14.000 | Yes | - |
| TE-433AB-AVG | AVG AIR IN TEMP -4A AH | DEG F | 109.900 | 113.361 | 2.262 | -3.321 | 10.000 | -14.000 | Yes | - |
| TE-433AD-AVG | AVG GAS OUT TEMP-4A AH | DEG F | 289.800 | 291.140 | 0.863 | -1.280 | 10.000 | -14.000 | Yes | 1 m |
| TE-433AA-AVG | AVG AIR OUT TEMP-4A AH | DEG F | 612.550 | 612.927 | 0.067 | -0.170 | 10.000 | -14.000 | Yes | - |
| PDT-420AA | AH DIFF PRESS 4A | IN WC | 1.722 | 1.6946 | 0.612 | -0.068 | 1.000 | -2.000 | Yes | 1 |
| E-420AA | AH HOTEND BG 4A AH TEMP | DEG F | 137.173 | 138.489 | 1.266 | -1.317 | 10.000 | -14.000 | Yes | |
| E-420AB | AH CLDEND BG 4A AH TEMP | DEG F | 97.301 | 98.280 | 1.151 | -0.979 | 10.000 | -14.000 | Ye | 1 m |
| TE-444CA | AMBIENT AIR (RTD) | DEG F | 66.380 | 66.755 | 0.273 | -0.375 | 25.000 | -10.000 | Yes | |

1-

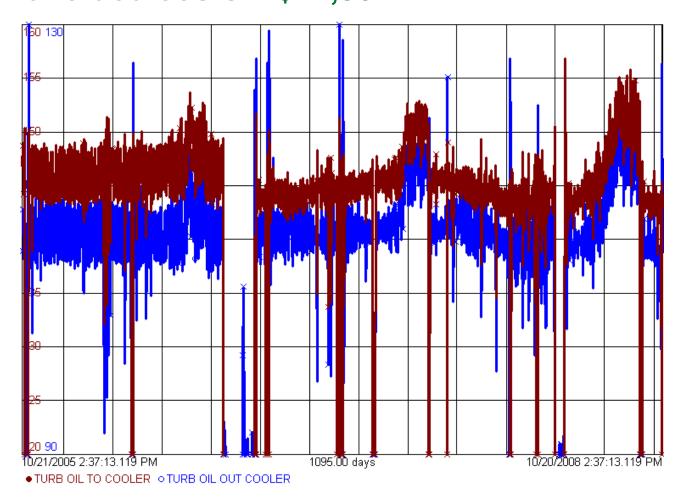
Air Heater Hot End Bearing avoided costs = \$32,285



Lube Oil Heat Exchanger avoided costs = \$17,504

| | wer - [point_summary-p.dis] | | | | | | | | | |
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| <u> </u> |) 🔄 🕇 🗊 🖻 🖻 🛛 point_su | mmary-p 🔻 🤋 🎙 ? | point_su | mmary- | | | | | | |
| 10-DEC-08 | BAD: 8 Health | PdP POINT S | | Y | | | | | | |
| 8:32:02 | IVM: 0 🔴 | Roxboro | Unit 3 | _ | | | | | | |
| UNIT | rox3 FRE | QUENCY 300 seconds | τοται | POINTS 43 | 4-Pt | frend | | atus Legen | | |
| | 1000 | | | | 9-PU | | AE | BNORMAL | NORMAL | INACTIVE |
| MODEL | oronanip | LDATN PARAMTR 0.90 | | | GROL | IP PLOT OPTIC | NS | Da | ta Mine | r |
| 3 TURBINE MECH | | TOFF POINT PT-310B-SEL | | ALUE 861.7 | 1 🙆 | | | - | | |
| CATEGORY | OK | SCRIPTION 1ST STAGE PR | ESS-SELEC | TED | RAD | | - | ASS | ESSMEN | AL I |
| MODEL STATUS | NORMAL | TOFF: HIGH LIMIT 200 | 00. LO | A LIMIT 300 | | | | - | | - |
| MODEL HEALTH | 0.976 Assign Category | ALARMS: X out of Y | X = 18 | 3 Y = 20 | | larm owledge — | Alarm on: | | / P20 | e 1 of 2 |
| MODEL HEALTH | 0.010 | | | | | | Residual | | | |
| INPUT POINT | DESCRIPTION | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG AC | t trend |
| PT-310B-SEL | 1ST STAGE PRESS-SELECTED | PSI | 861.710 | 866.756 | 0.018 | -1.535 | 0.000 | 0.000 | Yes | 1 |
| TE-310AB | T/G BRG 1A | DEG F | 191.368 | 191.786 | 0.594 | -0.750 | 10.000 | -14.000 | Yes | - |
| TE-310AC | T/G BRG 1B | DEG F | 206.387 | 206.381 | 0.004 | 0.005 | 10.000 | -14.000 | Yes | - |
| TE-310BB | T/G BRG 2A | DEG F | 185.054 | 185.048 | 0.002 | 0.006 | 10.000 | -14.000 | Yes | |
| TE-310BC | T/G BRG 2B | DEG F | 202.762 | 201.250 | 0.410 | 1.512 | 10.000 | -14.000 | Yes | 1 |
| TE-310CB | T/G BRG 3A | DEG F | 169.824 | 170.209 | 0.369 | -0.385 | 10.000 | -14.000 | Yes | - |
| TE-310CC | T/G BRG 3B | DEG F | 187.377 | 188.536 | 1.138 | -1.492 | 10.000 | -14.000 | Yes | |
| TE-310DB | BRG#1LTMTL | DEG F | 168.141 | 167.149 | 0.664 | 0.656 | 10.000 | -14.000 | Yes | - |
| TE-310DC | BRG#IRTMTL | DEG F | 186.551 | 183.403 | 3.142 | 3.808 | 10.000 | -14.000 | Yes | |
| TE-310EB | BRG#1LTMTL | DEG F | 157.000 | 157.187 | 1.310 | 0.823 | 10.000 | -14.000 | Yes | - |
| TE-310EC | BRG#2LTMTL | DEG F | 168.821 | 169.297 | 0.852 | -0.476 | 10.000 | -14.000 | Yes | 1 |
| TE-310FB | BRG#2RTMTL | DEG F | 159.879 | 159.325 | 0.774 | 0.554 | 10.000 | -14.000 | Yes | 1 - C |
| TE-310FC | BRG#2LTMTL | DEG F | 163.597 | 164.818 | 1.902 | -1.221 | 10.000 | -14.000 | Yes | 1 <u>~</u> |
| TE-310GB | TBMTL RCWEST | DEG F | 156.830 | 157.155 | 0.414 | -0.325 | 10.000 | -14.000 | Yes | 1 |
| TE-310GC | TBMTL REWEST | DEG F | 166.632 | 167.233 | 1.076 | -0.601 | 10.000 | -14.000 | Yes | 1 |
| TE-310HB | TBMTL FCWEST | DEG F | 158.688 | 159.262 | 0.657 | -0.575 | 10.000 | -14.000 | Yes | |
| TE-310HC | TBMTL FEWEST | DEG F | 167.973 | 168.773 | 1.078 | -0.968 | 10.000 | -14.000 | Yes | |
| TE-310IB | TBMTL RCEAST | DEG F | 167.300 | 166.971 | 0.541 | 0.329 | 10.000 | -14.000 | Yes | |
| TE-310IC | TBMTL REEAST | DEG F | 168.646 | 168.111 | 0.833 | 0.536 | 10.000 | -14.000 | Yes | 1 <u>~</u> |
| TE-310JB | TBMTL FCEAST | DEG F | 159.872 | 160.204 | 0.409 | -0.331 | 10.000 | -14.000 | Yes | |
| TE-310JC | TBMTL FEEAST | DEG F | 165.278 | 167.510 | 5.162 | -2.233 | 10.000 | -14.000 | Yes | 1 <u>~</u> |
| TE-310KB | T/G BRG 11A | DEG F | 150.197 | 143.323 | 6.784 | 6.874 | 10.000 | -14.000 | Yes | |
| TE-310LC | T/C BRG 12B | DEG F | 150.367 | 149.170 | 1.648 | 1.197 | 10.000 | -14.000 | Yes | <u></u> |
| TE-310MC | THST FTPLT UPPR BRG TEMP | DEG F | 149.352 | 149.277 | 0.119 | -0.096 | 10.000 | -14.000 | Yes | 1 m |

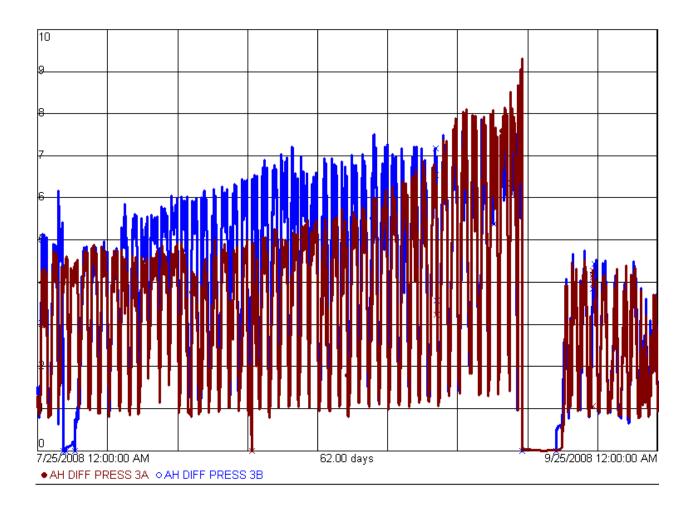
Lube Oil Heat Exchanger avoided costs = \$17,504



Air Heater Differential avoided costs = \$11,760

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| 10-DEC-08 BAD: 8 Health PdP POINT SUMMARY 8:33:40 IVM: 0 Roxboro Unit 3 | | | | | | | | | | | |
| UNIT | rox3 | FREQUENCY | | | POINTS 6 | | frend | | atus Legend BNORMAL - N | | |
| MODEL 3A AIR HEATER | 3aAHTRp | Valdatn P Cutoff Poi | | | ALARM 0 | GROU | | ONS | Dat | a Mine | r |
| CATEGORY | ок | DESCRIPTIO | | | | Read | | - | ASSE | SSME | NT |
| MODEL STATUS | NORMAL | CUTOFF: | | | W LIMIT 550 | A | larm | Alarm on: | ALT | Z 1 | _ |
| MODEL HEALTH | 0.992 Assign C | ategory ALA | RMS: X out of Y | X = 18 |) Y = 20 | Ackn | owledge | Residual | | Pag | e 1 of 1 |
| INPUT POINT | DESCRIPTION | | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG AC | t trend |
| TE-320AA | HOT END BRG 3A AH | | DEG F | 128.406 | 124.192 | 0.710 | 1.793 | 10.000 | -14.000 | Yes | - |
| TE-320AB | COLD END BRG 3A A | н | DEG F | 85.268 | 86.356 | 1.152 | -1.622 | 10.000 | -14.000 | Yes | 1- |
| TE-333AA-AVG | AVG AIR IN TEMP -3 | A AH | DEG F | 96.140 | 94.134 | 0.973 | 1.546 | 0.000 | 0.000 | Yes | - |
| TE-320AC-AVG | 3A AH GAS IN AVG | | DEG E | 717.514 | 719.356 | 0.485 | -2.448 | 0.000 | 0.000 | Yes | - |
| PDT-320AA | AH DIFF PRESS 3A | | IN WC | 4.658 | 4.3384 | 0.872 | 0.146 | 1.000 | -2.000 | Yes | 1-1- |
| TE-344B | AMDIENTAIK | | DEG F | 07.721 | 04.799 | 1.899 | J.02J | 15.000 | -15.000 | Yes | |

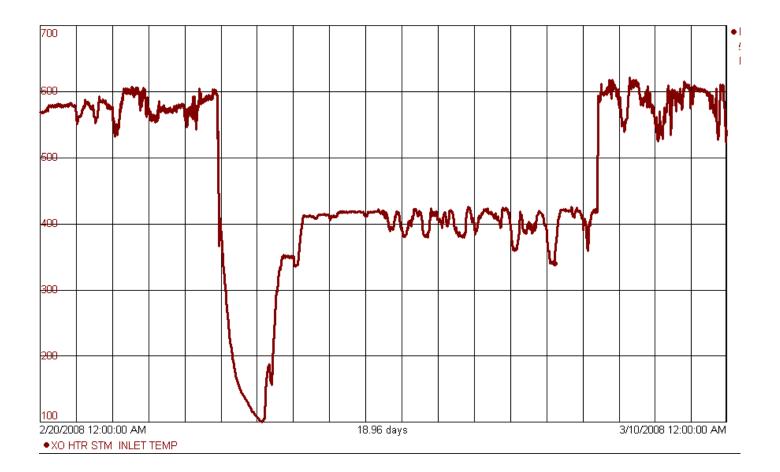
Air Heater Differential avoided costs = \$11,760



XO Feedwater Heater Extraction Valve avoided costs = \$18,521

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| 10-DEC-08 BA 8:35:28 IV | | PdP POINT Roxboro | | Y | | | | | | |
| MODEL 4 4 TURBINE PERF | OK NORMAL 0.979 | | PNTS ir IFL V/ FLOW | POINTS 22 Alarm 2 Alue 2752.1 W Limit 2000 Y = 20 | GROU | | .4 AE DNS | | NORMAL ta Miner ESSMEN | |
| INPUT POINT | DESCRIPTION | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG AC | t trend |
| 410MAINSTMFLOV 4PENNET PT-413D 4LDC025 TE-429B | W MAIN STEAM FLOW UNIT 4 NET LOAD (ACTUAL TURB MN STM PRES THROTTLE PSI (SELECTED) MAIN STM TEMP | PSIG | 2752.097 507.726 2385.920 2396.243 1000.455 | 3765.62 511.455 2386.94 2395.61 995.255 | 4.465 0.120 0.035 0.041 1.010 | -1017.77 -3.730 -1.018 1.204 5.608 | 0.000 0.000 0.000 0.000 0.000 | 0.000 0.000 0.000 0.000 0.000 | Yes Yes Yes Yes Yes | |
| PT-410A PT-410B-SEL PT-430AA2 | HP TURB CHST PRESS 1ST STAGE PRESS-SELECT 4A CRH PRESS | PSIG FED PSI PSIG | 2338.989 1272.917 375.507 | 2347.88 1361.14 368.164 | 0.308 1.094 0.233 | -8.895 -90.437 6.969 | 0.000 0.000 0.000 | 0.000 0.000 0.000 | Yes Yes Yes | |
| PT-430BA2 TE-430B PT-410C TE-430A | 4B CRH PRESS CRH STM/TURB 4 RH BOWL PRESS HRH STM TO TURB 4 | PSIG DEG F PSIG DEG F | 368.457 574.129 333.476 737.050 | 364.568 570.366 331.359 0.0000 | 0.076 0.381 0.052 0.000 | 2.287 3.066 1.050 0.000 | 0.000 0.000 0.000 0.000 | 0.000 0.000 0.000 0.000 | Yes Yes Yes No | |
| TE-410PF TE-410PG PT-430A-SEL PT-430B-SEL | IP TRB EXH A IP TRB EXH B 4A RH OUTLET PRESS (SEL 4B RH OUTLET PRESS (SEL | | 681.534 680.707 354.656 354.680 | 689.940 688.236 348.230 345.154 | 1.365 1.216 0.253 0.391 | -8.406 -7.529 5.442 8.401 | 0.000 0.000 0.000 0.000 | 0.000 0.000 0.000 0.000 | Yes Yes Yes Yes | |
| TE-402B | XO HTR STM INLET TEMP | | 575.263 | 670 027 572,538 | 0.340 | 2.725 | 0.000 | 0.000 | Yes | |
| PT-410IPA PT-410IPB | IP THE STM TREET TEMP IP TRB EXH A PRES IP TRB EXH B PRES | PSIG PSIG | 832.535 111.745 110.715 | 843.038 104.912 103.896 | 0.926 0.921 | 6.489 6.475 | 0.000 | 0.000 | Tes Yes Yes | |
| 4LDC043 | TURB MASTER | % OP | 64.322 | 83.405 | 6.515 | -19.083 | 0.000 | 0.000 | Yes | |

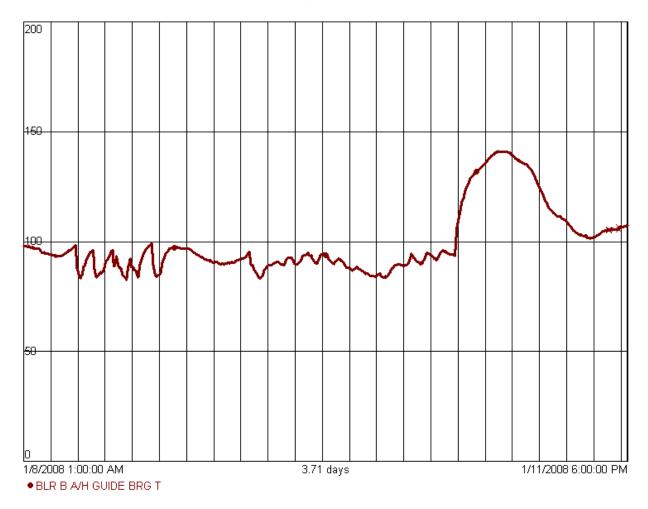
XO Feedwater Heater Extraction Valve avoided costs = \$18,521



AH Guide bearing cooling fan avoided costs = \$2,613

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| 10-DEC-08 BA 8:37:14 IVN | | PdP POINT S Mayo Ur | | Y | | | | | | |
| UNIT | myo1 FR | EQUENCY 300 seconds | TOTAL | POINTS 8 | 4-Pt 1 | rend | | atus Legen NORMAL | | |
| MODEL 1 | 1bAHTRp VA | LDATN PARAMTR 0.90 | PNTS in | ALARM 0 | GROU | | | | a Mine | _ |
| 1B AIR HEATER | | TOFF POINT A1404T_DAS | | ALUE 631.0 | ⁷ (o | | | Dat | a wine | |
| CATEGORY | UK | SCRIPTION AIR HTR BINLE | | | RADIO | II INEAR | - | ASSE | SSME | T |
| MODEL STATUS | NORMAL | TOFF: HIGH LIMIT 400 | | ₩ LIMIT 500 | A | arm | Alarm on: | | - | _ |
| MODEL HEALTH | 0.976 Assign Category | ALARMS: X out of Y | X = 18 | Y = 20 | Ackno | owledge | Residual | | Pag | e 1 of 1 |
| INPUT POINT | DESCRIPTION | UNITS | ACTUAL | PREDICTD | VARIANCE | RESIDUAL | RESID HI | RESID LO | SIG AC | t trend |
| A1400T | AIR HTR B INLET AIR TMP | DEG F | 127.901 | 124.692 | 0.483 | 2.904 | 0.000 | 0.000 | Yes | 1 |
| A1404T DAS | AIR HTR B INLET GAS TMP | DEG F | 631.067 | 619.728 | 0.778 | 11.339 | 0.000 | 0.000 | Yes | |
| A1405T DAS | AIR HTR B OUTLET AIR TMP | DEG F | 535.970 | 580.835 | 3.321 | -44.865 | 0.000 | 0.000 | Yes | 1- |
| A1406T | AIR HTR B OUTLET GAS TMP | DEG F | 274.943 | 271.296 | 0.386 | 3.263 | 0.000 | 0.000 | Yes | 1 <u>~</u> |
| A4454T DAS | PLD D AALCUDDODT DDC T | DECE | 77.457 | 04.600 | 4.050 | 4 202 | 40,000 | 44,000 | Yes | 1- |
| A1452T DAS | BLR B A/H GUIDE BRG T | DEG F | 102.916 | 96.856 | 1.525 | 6.060 | 10.000 | -14.000 | Yes | 1 <u>~</u> |
| A1405P | B AIR HTR GAS D/P | IN WC | 3.345 | 3.0437 | 0.395 | 0.197 | 1.000 | -1.000 | Yes | 1- |
| A1005T DAS | AMBIENT TMP | DEG F | 67.297 | 66.503 | 0.136 | 0.794 | 10.000 | -15.000 | Yes | 1 |

AH Guide bearing cooling fan avoided costs = \$2,613



QUESTIONS ???









