

## PMAX MW ADVISOR Fossil Application

Erin Carroll – Scientech January 14, 2009



# **MW Advisor Calculation Overview**

- Typical Heat Kit C-Loss Parameters-MS & RH deviations, SH & RH sprays, cond BP, blr O2 & GET, & Aux Power
- Additional C-Loss Parameters- Blowdown & makeup flows, FWH TTD's & DCA's, condenser subcooling, etc.
- Report both heat rate and mw effects in addition to \$/Hr for all monitored parameters



# **MW Advisor Calculation Overview**

- PEPSE model(s) built and tuned to plant data
- HR and MW deviation curves built from multiple PEPSE runs for each monitored parameter
- Curves integrated into PMAX models
- Presentation of results



### **Controllable Loss—Typical**

-JAN-09 BAD: 5:08:20 IVM: 2	<ul> <li>Health</li> <li>Alarm</li> </ul>	B	c	ONT		LE L	OSS SI UNIT#8	UMN	IARY		ross Tur	Gro: b Heat Rat	ss Lo te (Bi	ad (MW) tu/kWHr)	545.39 824
		TOTAL COSTS (\$/HR) 88.53								Net Un	it Heat Ra	te (B	tu/kWHr)	1013	
													SAVINGS		
ALARM	<b>2</b> 5.0		<b>160</b> 10.0	120	80 5.0	4	<b>0</b> 5.0	0	40 12.0	80	120 5.0	<b>160</b>	2	5.0	5.0
COST \$/HR	2.39	] 🗖	8.59		3.94		1.29		10.78	2	9.43	-9.47		-0.70	42.2
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#### **Controllable Loss—Modeler Inputs**

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Controllable Loss - CNTLOS5	Controllable Loss - CNTL	055
Controllable Loss - CNTLOSS         Page 1       Page 2       Page 3       Page 4       Page 5         Common       Name:       CNTLOSS       Date M         Description:       US CLTURB CYCLE ONLY       Project:         Prepared By:       G.WEBER       Project:         Static       Image 1       Common         Static       Description       I/O       Units         Auxiliany Power Execution (Y/N)       I       Common       Common         Boiler Execution (Y/N)       I       O       Common       Common         Barometric Pressure       I       IN HG       731       C EU         Throttle Steam Temperature       I       DEG F       701       C EU         Throttle Steam Temperature       I       DEG F       702       E EU         Condenser Back Pressure       I       IN HG       736       C EU         Actual Heat Rate       I       BTU/KwH       2870       C EU         Gross Generation       I       KW       0       EU         Fuel Cost       I       \$/MBTU       409       C EU         Procent Unburned Carbon       I       %/MBTU       409       C EU	Modified:       04/30/97         No:       1-110         tt:       Pow5         S       No         s       No         s       No         c       Constant         C       Constant <tr< th=""><th>OSS         X           3] Page 4] Page 5]           D355           D355           D355           Date Modified:         04/30/97           Page No::         1-110           Project:         Pow5           BER         I           I         %     &lt;</th></tr<>	OSS         X           3] Page 4] Page 5]           D355           D355           D355           Date Modified:         04/30/97           Page No::         1-110           Project:         Pow5           BER         I           I         %     <
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#### **Controllable Loss—Modeler Outputs**

Controllable Loss - CNTLOS5	X		•
Page 1       Page 2       Page 3       Page 4       Page 5         Common       Name:       CNTLOS5         Description:       U5 CL TURB CYCLE ONLY         Prepared By:       G.WEBER         Static       Description       I/O         Units       Throttle Steam Temp Cost       0       \$/HR         Throttle Steam Temp Cost       0       \$/HR       916         Hot Reheat Temperature Cost       0       \$/HR       927         Condenser Back Pressure Cost       0       \$/HR       938         Q2 Cost       0       \$/HR       939         Exit Gas Temperature Cost       0       \$/HR       939         Auxiliary Power Cost       0       \$/HR       939         Heat Rate Cost       0       \$/HR       939         Cost for 1% HR Deviation       0       \$/HR       830	Date Modified:       04/30/97         Page No.:       1-110         Project:       Pow5         Image: Image No.:       1-110         Project:       Pow5         Image: Image No.:       1-110         Project:       Pow5         Image: Image No.:       1-10         Image: Image No.:       Pow5         Image No.:       Pow6         Image No.:       Pow6	TLOSS         e 3 Page 4 Page 5         TLOSS         CL TURB CYCLE ONLY         ZEBER         n       I/O         units         mp HR Penalty       0         BTU/KWH         HR Penalty       0         BTU/KWH         Press HR Penalty       0         BTU/KWH         Press HR Penalty       0         BTU/KWH         Penalty       0         BTU/KWH         Q       BTU/KWH         Q       BTU/KWH         Q       BTU/KWH         Q       BTU/KWH         Q       BTU/KWH	Date Modified:         04/30/97           Page No.:         1-110           Project:         Pow5           915         ○ EU           920         ○ EU           983         ○ EU           9997         ○ EU           9397         ○ EU           9397         ○ EU           938         ○ EU           9397         ○ EU           938         ○ EU
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# **MW Advisor—Typical**

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7:18:	47 IVM:	0	Alarm 🍎		Poplar River Unit 2			Gross Turb H	eat Rate (KJ/KG)	8445.6	I
								Net Unit H	eat Rate (KJ/KG)	10715.4	
MENU		CONT	ROLLABLE TU	RBINE LOSSES	ACTUAL		TARGET	HEAT RATE LOSSES (KJ/KWH)	MW EFFECTS (MWe)	TOTAL COST (\$/HR)	
			Main Steam T	emperature	537.5	DEG C	537.8	0.7	0.0	-0.31	
***			Main Steam P	ressure	12827	KPA	12507.1	-17.1	6.2	7.50	
222			Reheat Steam	Temperature	523.2	DEG C	537.8	35.2	-3.2	-15.44	
			Aux Steam Flo	w	0.7	KG/S	0.0	10.2	-0.0	-1.26	
PUMP	OPERAT	IONS	Blowdown Flo	w	0.1	KG/S	0.0	2.9	0.0	-1.26	
	LOSS SUN	MARY	SH Spray Flov	v	1.9	KG/S	0.0	3.9	0.2	-1.70	
BLB			RH Spray Flov	N	0.3	KG/S	0.0	2.5	0.3	-1.08	
Ψ			LP Exhaust P	ressure	8.7	KPA	8.3	17.8	-0.5	-7.82	
			Condenser Si	ubcooling	0.0	DEG C	0.0	0.0	0.0	0.00	
BLR SB			Final FW Tem	p	231.6	DEG C	226.7	-14.2	-1.7	6.23	
-			FWH TTD					-60.3?	1.2?	26.43?	
			FWH DCA					0.6	-0.0	-0.26	
			Makeup Flow		1.5	KG/S	0.0	44.9	-0.3	-19.49	
EWH			BFP Enthalpy	Rise	0.0	KJ/KG	0.0	0.0	0.0	0.00	
II-			CEP Enthalpy	Rise	0.0	KJ/KG	0.0	0.0	0.0	0.00	
			Station Aux P	ower	0.0	MWe	0.0	401.5	-24.3	-175.98	
UTIL		Total C	Controllable Tu	rbine Losses				0.0	0.0	0.00	
		UNCO	NTROLLABLE	TURBINE LOSSE	S						
CALC			Internal Turbi	ne Losses				0.0	0.0	0.00	
-	TURBI	NES	<b>Power Factor</b>		0.99	FRAC	0.90	-9.5	0.3	4.18	
MAN	NORI	AL	Generator Hy	drogen Pressure	398.7	KPA	411.353	-0.7	0.0	0.29	
			Reheat Press	ure Drop	0.061	FRAC	0.058	1.9	-0.2	-0.83	
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#### **EXCEL Macro—FWH 4 DCA Effect**

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Sheet2 (Sheet2)	Dim runjob As Object					
ThisWorkbook	Dim Loads(7) As String	ſ				
E 😁 Modules	loads(1) = "MDF"					
Module1	loads(2) = "315 MW"					
🗄 😻 VBAProject (steam.xla)	loads(3) = "MCR"					
	loads(4) = "75%"					
	loads(5) = "50%"					
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	' open model					
	Set Pepse = CreateObje	ct("Pepse.Application")				
	Set model = Pepse.Oper	("C:\pepse\pr2_pmax.mdl"	")			
	Set job = model.JobDes	cription(1)				
	job.InputFile = "C:\pe	pse\pr2 pmax.JOB"				
	job.CloseWindow = True	-				
	Set component = model.	component(330, 1)				
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#### MW Advisor—Models & Spreadsheets

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# **MW Advisor—Benefits**

- Refined approach to identifying and reporting Controllable Loss parameters
- Reported parameters not restricted to standard heat kit correction curves
- Utilized extensively throughout PMAX nuclear installations
- Alarming criteria can be assigned to report exceptions



#### Alarm Management of Critical Parameters

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Pdp	3bPULFDp	3113501c	U1 C M	ILL MOTOR	AMPS		AMPS	100.980	100.000	NUI	12/11 09:06:33.
Pdp	3cPULFDp	3113501D	U1 D M	ILL MOTOR	AMPS		AMPS	102.370	100.000	NUI	12/11 09:06:33.
Pdp	3dPULFDp	3113501E	U1 E M	ILL MOTOR	AMPS		AMPS	100.660	100.000	NUI	12/11 09:06:33.
Cmax	31HPFWHp	3LC0201	U1 2 F	WH LEVEL			INWC	7.980	7.800	NUI	12/11 09:06:33.
Cma	34LPFWHp	3LC0501	U1 5 F	WH LEVEL			INWC	7.020	7.500	NUI	12/11 09:06:33.
Cma	3aCONDPp	3PD12031A	U1 AH	A DRAFT DP			INWC	8.100	8.000	NUI	12/11 09:06:33.
Pmax	· 35LPFWHp	3PI0601	<b>U1</b> EXT	то 6 гмн	PRESS		PSIG	7.202	-1.400	NUI	12/11 09:06:33.
Pmax	36LPFWHD	3PI0701	U1 EXT	ТО 7 ЕМН	PRESS		PSIA	8.577	10.800	NUI	12/11 09:06:33.
Pmax	3bBFPPp	3PI1202A	U1 A B	FP DISCHAR	GE PRESS		PSIG	3261.300	3100.000	NUI	12/11 09:06:33.
	TIVE	Applica	tions	ACTIVE	A11	Alarms	by Time	Unack		age 1	$\Box$
M	essages		ACKN OP	OWLEDGE A	ck Page Acl	Cagtegory	Ack All		C'd Pag 116	je 1 of more a	larm(s)
Display Pro	gram Activation.								USER: R*X	\$SERVER: foss	ild NUM

#### Questions ??

JRTISS WRIGHT Flow Control Company SCIENTECH

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R*TIME Da	a <b>ta Viewer - [CL</b> View Display	. <b>055.DIS]</b> Viewer Sec	urity Window Help							
	3 <b>D</b> C			₹ 8 k?		closs				
14-JAN	-09 BAD:	45	Health 🔵		PMAX Loss Adviso	r		C	Gross Load (MW)	235.101
7:18:	47 IVM:	0	Alarm 🍎	_	Poplar River Unit 2			Gross Turb H	leat Rate (KJ/KG)	8445.6
								Net Unit H	leat Rate (KJ/KG)	10715.4
MENU		CONT	ROLLABLE TU	JRBINE LOSSES	ACTUAL		TARGET	HEAT RATE LOSSES (KJ/KWH)	MW EFFECTS (MWe)	TOTAL COST (\$/HR)
			Main Steam	Temperature	537.5	DEG C	537.8	0.7	0.0	-0.31
222			Main Steam I	Pressure	12827	KPA	12507.1	-17.1	6.2	7.50
444			Reheat Stear	n Temperature	523.2	DEG C	537.8	35.2	-3.2	-15.44
			Aux Steam F	low	0.7	KG/S	0.0	10.2	-0.0	-1.26
PUMP	OPERAT	IONS	Blowdown Fl	low	0.1	KG/S	0.0	2.9	0.0	-1.26
	LOSS SU	MMARY	SH Spray Flo	W	1.9	KG/S	0.0	3.9	0.2	-1.70
			RH Spray Flo	W	0.3	KG/S	0.0	2.5	0.3	-1.08
			LP Exhaust F	Pressure	8.7	KPA	8.3	17.8	-0.5	-7.82
			Condenser S	Subcooling	0.0	DEG C	0.0	0.0	0.0	0.00
BLR SB			Final FW Ten	np	231.6	DEG C	226.7	-14.2	-1.7	6.23
			FWH TTD					-60.3?	1.2?	26.43?
			FWH DCA					0.6	-0.0	-0.26
			Makeup Flow	v	1.5	KG/S	0.0	44.9	-0.3	-19.49
FWH			BFP Enthalp	y Rise	0.0	KJ/KG	0.0	0.0	0.0	0.00
The second second			CEP Enthalp	y Rise	0.0	KJ/KG	0.0	0.0	0.0	0.00
1170			Station Aux F	Power	0.0	MWe	0.0	401.5	-24.3	-175.98
UTIL		Total C	ontrollable Tu	urbine Losses				0.0	0.0	0.00
		UNCO	NTROLLABLE	TURBINE LOSSES	1					
CALC			Internal Turb	ine Losses				0.0	0.0	0.00
-	TURB	INES	Power Facto	r	0.99	FRAC	0.90	-9.5	0.3	4.18
MAN	NOR	VIAL	Generator Hy	drogen Pressure	398.7	KPA	411.353	-0.7	0.0	0.29
			Reheat Press	sure Drop	0.061	FRAC	0.058	1.9	-0.2	-0.83
		Total U	ncontrollable	Turbine Losses				0.0	0.0	0.00
		ΤΟΤΑ		D DEVIATIONS				0.00	0.00	0.00
TRENDS										
									from a from the second	

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