

Exhibit No.: 014
Issues: Heat Rate/Efficiency
Testing
Witness: Mark C. Birk
Sponsoring Party: Union Electric Company
Type of Exhibit: Direct Testimony
Case No.: ER-2008-0318
Date Testimony Prepared: April 4, 2008

MISSOURI PUBLIC SERVICE COMMISSION

Case No. ER-2008-0318

DIRECT TESTIMONY

OF

MARK C. BIRK

ON

BEHALF OF

**UNION ELECTRIC COMPANY
d/b/a AmerenUE**

St. Louis, Missouri
April, 2008

COMPANY
Exhibit No. 14
Case No(s) ER-2008-0318
Date 12-3-08 Rptr RP

1 **DIRECT TESTIMONY**

2 **OF**

3 **MARK C. BIRK**

4 **CASE NO. ER-2008-____**

5 **Q. Please state your name and business address.**

6 A. My name is Mark C. Birk. My business address is One Ameren Plaza,
7 1901 Chouteau Avenue, St. Louis, Missouri 63103.

8 **Q. By whom and in what capacity are you employed?**

9 A. I am employed by Union Electric Company d/b/a AmerenUE ("Company" or
10 "AmerenUE") as Vice President of Power Operations.

11 **Q. Please describe your educational background and employment**
12 **experience.**

13 A. I received my B.S.E.E. from the University of Missouri-Rolla in 1986 and my
14 M.S.E.E. from the same institution in 1991. I am a licensed engineer in the State of
15 Missouri. I began my employment with Union Electric Company in 1986 as an assistant
16 engineer in the nuclear function. In 1989, I transferred to Union Electric's Meramec Power
17 Plant as an electrical engineer. In 1996, I transferred to the Energy Supply Operations Group
18 and became a Power Supply Supervisor. I became Manager of Energy Supply Operations in
19 the Spring of 2000. I became General Manager of Energy Delivery Technical Services in the
20 Fall of 2001 and Vice President of that department in 2002. I became Vice President of
21 Ameren Energy, Inc., Ameren Corporation's short-term trading affiliate, in the fall of 2003
22 and assumed my current position with AmerenUE as Vice President of Power Operations in
23 September of 2004.

1 **Q. Please summarize your duties and responsibilities as Vice President of**
2 **Power Operations for AmerenUE.**

3 A. I am responsible for all of the generation assets of AmerenUE, except the
4 Callaway Nuclear Plant, which is within the responsibility of Charles D. Naslund. In
5 addition to being chief safety officer for the non-nuclear generation, I am also responsible for
6 the safe, reliable and efficient operation of the plants and the design, construction
7 management and implementation of all plant related projects.

8 **Q. What is the purpose of your direct testimony?**

9 A. The purpose of my direct testimony is to address 4 CSR 240-3.161(2)(P),
10 which is a minimum filing requirement in the Commission's fuel adjustment clause ("FAC")
11 rules.

12 **Q. What is requirement (P) of 4 CSR 240-3.161(2)?**

13 A. Requirement (P) requires a schedule and testing plan with written procedures
14 for heat rate and/or efficiency tests for the utility's generating units.

15 **Q. What is a unit's "heat rate"?**

16 A. A unit's heat rate is a measure of its relative efficiency, expressed
17 mathematically as the number of British thermal units ("BTUs") a unit consumes to generate
18 a kilowatt-hour ("kWh") of electricity. For example, a unit that consumes approximately
19 9,300 BTUs of fuel to generate a kWh of electricity has a heat rate of 9,300 and is more
20 efficient (consumes less fuel per kWh produced) than, for example, a unit with a heat rate of
21 10,000.

1 **Q. Why does AmerenUE monitor heat rates?**

2 A. By monitoring heat rates, the Company can track the efficiency of its units
3 and address observed reductions in a unit's efficiency appropriately. This, in turn, allows the
4 Company to make efficient use of the fuel it buys by getting as much electric generation as it
5 reasonably can from each unit of fuel burned.

6 **Q. How does AmerenUE monitor heat rates?**

7 A. With very limited exceptions for older combustion turbine units ("CTGs") that
8 are run very infrequently each year, AmerenUE uses real-time performance monitoring
9 systems on its generating units. Before such systems were in place, AmerenUE would have
10 to conduct a heat rate test during some limited, defined period (typically four hours) to get
11 the heat rate for that four hour period. By contrast, performance monitoring systems allow
12 AmerenUE to continuously track and record generator output, heat rates, and controllable
13 parameters. Plant operators use this real time performance information to continuously
14 optimize the heat rates of the AmerenUE fossil units by making the necessary operational
15 adjustments. This information also allows AmerenUE to use data from a much longer and
16 more representative time period to establish a baseline heat rate for each unit, which in turn
17 allows the Company to track the efficiency of the units.

18 Sample performance monitoring reports for the Callaway nuclear plant, one of
19 the Company's coal-fired base load units, and one of the Company's gas-fired CTG units are
20 shown in Schedule MCB-E1. The data obtained from the performance monitoring system as
21 shown in the sample monitoring reports in Schedule MCB-E1 has been converted into a heat
22 rate curve and an input/output curve for those same units in Schedule MCB-E2.

1 **Q. Please describe the data depicted on Schedules MCB-E1 and Schedule**
2 **MCB-E2.**

3 A. The first page of Schedule MCB-E1 is a sample performance monitoring
4 report for the Callaway Plant which shows the heat rate for a two-day period during
5 February, 2008. For example, the net heat rate was 9,778 BTUs per kWh (see column 5) on
6 February 1 at hour beginning 23, at an output level of 1,243 net megawatts ("MW") (see
7 column 4). The first page of Schedule MCB-E2 contains a heat rate versus net load curve for
8 the Callaway Plant using the performance monitoring data for the entire month of February
9 2008. Also contained on Schedule MCB-E2 is an input/output curve for the Callaway Plant
10 using data for the same time period. The input/output curve is related to the heat rate curve
11 in that the heat input is the product of the generator output times the heat rate. Thus, the
12 input/output curve is another measure of a plant's performance and may also be used to
13 evaluate changes in plant performance from one period to another.

14 The second page of Schedule MCB-E1 is a sample performance monitoring
15 report for Labadie unit #3, a coal-fired unit. The Labadie data also contains data for the
16 entire month of February 2008. The performance monitoring report shows a unit net heat
17 rate of 10,079.48 BTUs per kWh at an output level of 594.48 net MW for the month. The
18 second page of Schedule MCB-E2 contains a heat rate curve and an input/output curve for
19 Labadie #3 using data for the entire month of February 2008.

20 The third page of Schedule MCB-E1 is a sample performance monitoring
21 report for Raccoon Creek unit #1, a combustion turbine generator, for two days in August
22 2007. This report shows a net heat rate of 12,414 BTUs per kWh (see column 4) on August
23 1, hour beginning 15, at an output level of 70.9 MW (see column 2). The third page of

1 Schedule MCB-E2 contains a heat rate curve and an input/output curve for Raccoon
2 Creek #1 using data for the entire month of August 2007.

3 **Q. Please describe AmerenUE's heat rate/efficiency procedures.**

4 A. AmerenUE uses the heat rate data obtained from the performance monitoring
5 systems for its nuclear plant, its coal-fired units and its CTGs when the performance
6 monitoring data is available. Schedule MCB-E3 lists the AmerenUE units and the type of
7 performance monitoring system currently in use for each unit. As noted in Schedule
8 MCB-E3, there are a few units for which performance monitoring systems are not in place,
9 all of which are older CTGs that are run very, very infrequently each year. In fact, the
10 combined generation for these units was just 0.01% of the total nuclear, coal, natural gas, and
11 oil generation for 2007. Because these units are such a small portion of AmerenUE's
12 generation, the cost of performance monitoring systems for these units is not justified by the
13 benefit of monitoring these systems more closely. For these units, AmerenUE uses
14 accounting records to determine the heat rates.

15 Procedures for each type of plant (nuclear, coal-fired, CTG) are attached to
16 this testimony in Schedule MCB-E4, as follows: "Callaway Plant Engineering and Technical
17 Procedure ETP-ZZ-01101 Plant Derates and Efficiencies," "Performance Reporting for
18 AmerenUE Fossil Steam Generating Units," "Performance Reporting for AmerenUE
19 Combustion Turbine Generators," and "Performance Reporting for AmerenUE Generating
20 Units Without Performance Monitoring Systems".

21 **Q. How often will testing be done?**

22 A. As shown in the last column of Schedule MCB-E3, testing will be done
23 annually. In general, the baseline heat rate test data will be done in December for the nuclear

Direct Testimony of
Mark C. Birk

1 and coal-fired units, and in August for the CTGs. If the unit is out of service or there was not
2 enough run time in those months, data from an earlier month may be substituted. However,
3 this period will not be used for the CTGs because of the limited amount of generation during
4 December. Since CTG generation typically occurs during the summer time period, the
5 summer month of August was selected as the appropriate baseline period for CTGs. Another
6 important fact to consider is that real time heat rates typically vary throughout the year based
7 upon ambient conditions, thus a 12 month heat rate testing interval will be used to avoid
8 comparisons of heat rates between cooler and warmer months.

9 **Q. Does this conclude your direct testimony?**

10 **A. Yes, it does.**

**BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI**

In the Matter of Union Electric Company)
d/b/a AmerenUE for Authority to File)
Tariffs Increasing Rates for Electric) Case No. ER-2008-____
Service Provided to Customers in the)
Company's Missouri Service Area.)

AFFIDAVIT OF MARK C. BIRK

STATE OF MISSOURI)
) ss
CITY OF ST. LOUIS)

Mark C. Birk, being first duly sworn on his oath, states:

1. My name is Mark C. Birk. I am employed by AmerenUE as Vice President of Power Operations.
2. Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of Union Electric Company, d/b/a AmerenUE, consisting of 6 pages, Attachment A and Schedules MCB-E1, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.
through MCB-E4
3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

Mark C Birk

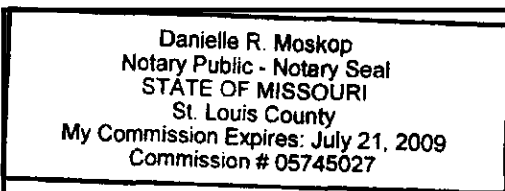
Mark C. Birk

Subscribed and sworn to before me this 4th day of April, 2008.

Danielle R. Moskop

Notary Public

My commission expires: _____



EXECUTIVE SUMMARY

Mark C. Birk

Vice President of Power Operations for AmerenUE

The purpose of my testimony is to address 4 CSR 240-3.161(2)(P), which is a minimum filing requirement in the Commission's fuel adjustment clause ("FAC") rules. Requirement (P) requires a schedule and testing plan with written procedures for heat rate and/or efficiency tests for the utility's generating units. A unit's heat rate is a measure of its relative efficiency, expressed mathematically as the number of British thermal units ("Btus") a unit consumes to generate a kilowatt-hour ("kWh") of electricity. For example, a unit that consumes approximately 9,300 Btus of fuel to generate a kWh of electricity has a heat rate of 9,300 and is more efficient (consumes less fuel per kWh produced) than, for example, a unit with a heat rate of 10,000.

By monitoring heat rates, the Company can track the efficiency of its units and address observed reductions in a unit's efficiency appropriately. This, in turn, allows the Company to make efficient use of the fuel it buys by getting as much electric generation as it reasonably can from each unit of fuel burned.

With very limited exceptions for older combustion turbine units ("CTGs") that are run very infrequently each year, AmerenUE uses real-time performance monitoring systems on its generating units. Before such systems were in place, AmerenUE would have to conduct a heat rate test during some limited, defined period (typically four hours) to get the heat rate for that four hour period. By contrast, performance monitoring systems allow AmerenUE to continuously track and record generator output, heat rates, and controllable

parameters. Plant operators use this real time performance information to continuously optimize the heat rates of the AmerenUE fossil units by making the necessary operational adjustments. This information also allows AmerenUE to use data from a much longer and more representative time period to establish a baseline heat rate for each unit, which in turn allows the Company to track the efficiency of the units.

Testing will be done annually. In general, the baseline heat rate test data will be done in December for the nuclear and coal-fired units, and in August for the CTGs. If the unit is out of service or there was not enough run time in those months, data from an earlier month may be substituted. However, this period will not be used for the CTGs because of the limited amount of generation during December. Since CTG generation typically occurs during the summer time period, the summer month of August was selected as the appropriate baseline period for CTGs. Another important fact to consider is that real time heat rates typically vary throughout the year based upon ambient conditions, thus a 12 month heat rate testing interval will be used to avoid comparisons of heat rates between cooler and warmer months.

Excel Extract Ver. 3.1

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Usage:
 1- Time format is MM/DD/YY HH:MM
 2- Interval format is STRING
 3- Plant ID format is SITE SERVICE POINTID
 4- Those cells pointed by the arrows have to be referenced by clicking on the cells, then the menu Insert-Define-Name
 5- Those names will be used in the macro sheet so that the DLL knows which cell it will get data from

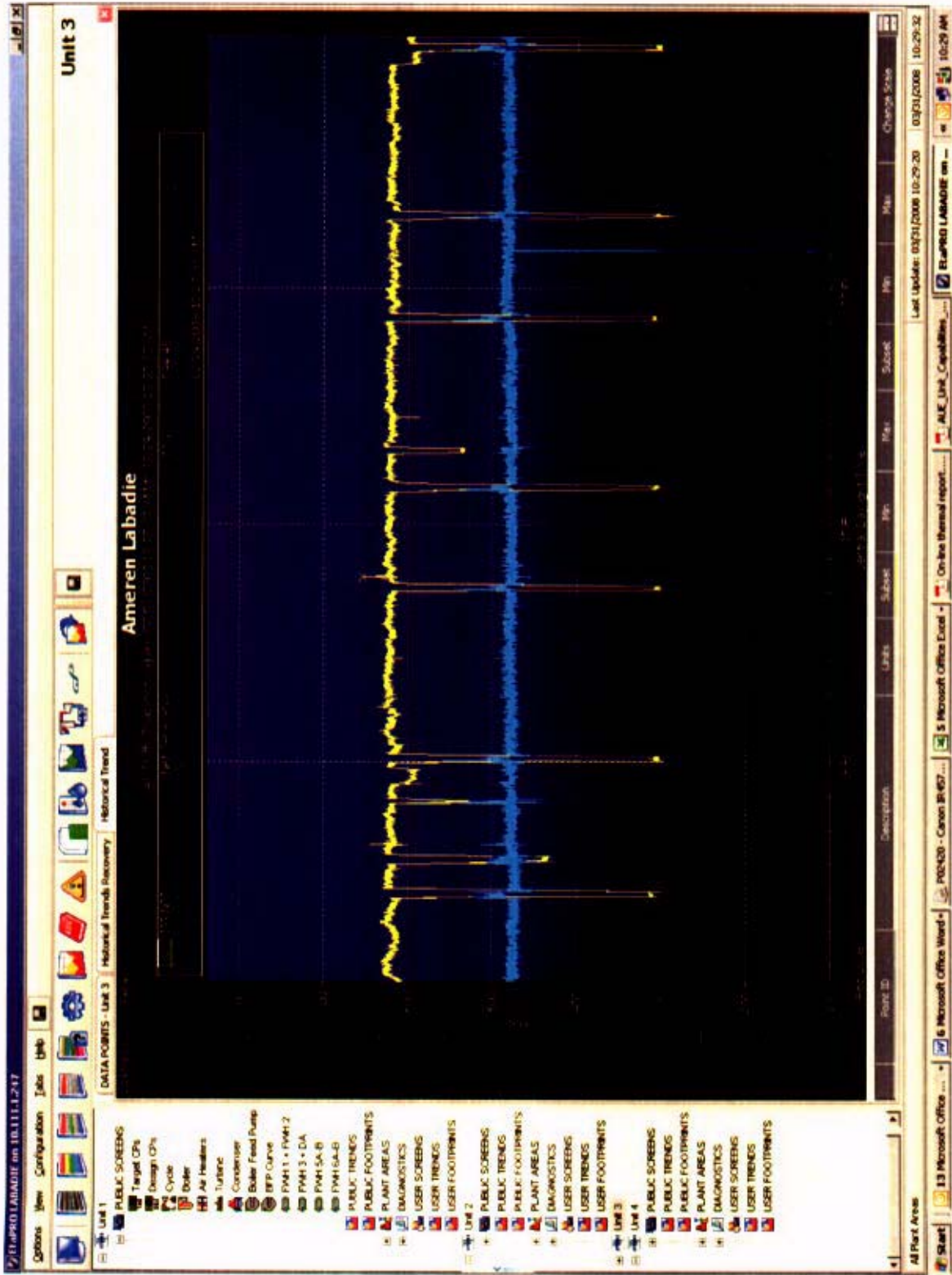
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End Time	03/01/2008 0:00
Interval	01:00:00

Start Time
End Time
Frequency



StarFill LINDEN2.CALC.0TO100

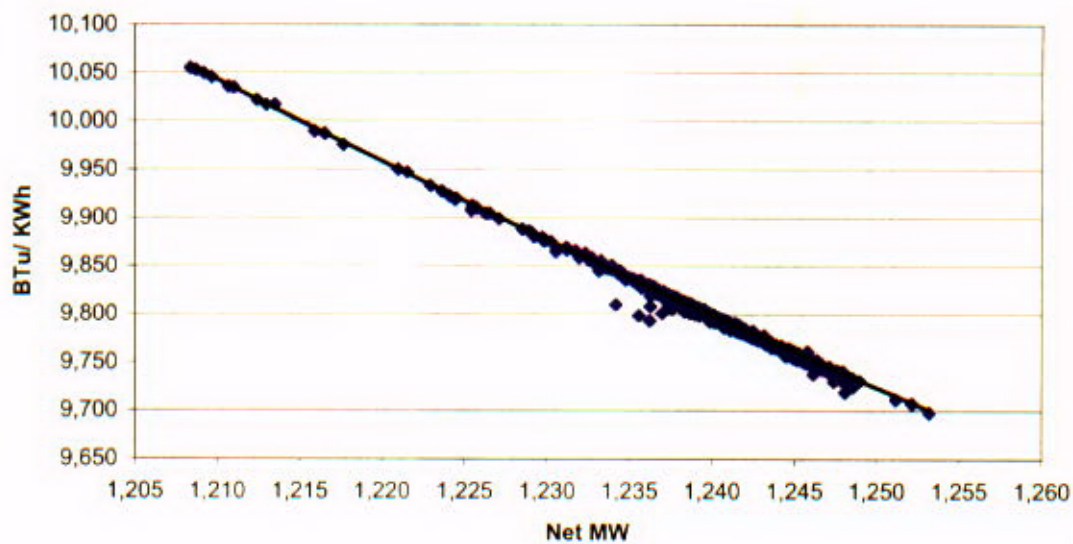
Date	Reactor Power MWth	Gross Generation MWe	Net Generation	Net Heat Rate (BTU/KWH)	MMBTU
02/01/2008 0:00	3.561	1,295	1,243	9,777	12,151
02/01/2008 1:00	3.561	1,294	1,241	9,790	12,151
02/01/2008 2:00	3.561	1,294	1,241	9,787	12,150
02/01/2008 3:00	3.562	1,294	1,242	9,787	12,153
02/01/2008 4:00	3.561	1,293	1,241	9,791	12,151
02/01/2008 5:00	3.561	1,294	1,242	9,786	12,152
02/01/2008 6:00	3.561	1,294	1,243	9,774	12,152
02/01/2008 7:00	3.561	1,294	1,244	9,767	12,151
02/01/2008 8:00	3.561	1,294	1,244	9,768	12,150
02/01/2008 9:00	3.562	1,294	1,245	9,764	12,153
02/01/2008 10:00	3.562	1,295	1,245	9,764	12,153
02/01/2008 11:00	3.561	1,295	1,245	9,760	12,149
02/01/2008 12:00	3.561	1,295	1,245	9,763	12,151
02/01/2008 13:00	3.561	1,294	1,243	9,771	12,150
02/01/2008 14:00	3.561	1,295	1,245	9,762	12,151
02/01/2008 15:00	3.560	1,296	1,245	9,754	12,149
02/01/2008 16:00	3.561	1,295	1,246	9,754	12,149
02/01/2008 17:00	3.561	1,295	1,245	9,759	12,150
02/01/2008 18:00	3.562	1,295	1,246	9,752	12,153
02/01/2008 19:00	3.561	1,295	1,246	9,755	12,152
02/01/2008 20:00	3.560	1,294	1,244	9,761	12,147
02/01/2008 21:00	3.561	1,293	1,244	9,770	12,150
02/01/2008 22:00	3.560	1,293	1,243	9,775	12,148
02/01/2008 23:00	3,561	1,293	1,243	9,778	12,151
02/02/2008 0:00	3.560	1,293	1,242	9,782	12,148
02/02/2008 1:00	3.562	1,293	1,242	9,791	12,156
02/02/2008 2:00	3.561	1,292	1,240	9,796	12,151
02/02/2008 3:00	3.561	1,292	1,240	9,798	12,151
02/02/2008 4:00	3.561	1,292	1,240	9,801	12,149
02/02/2008 5:00	3.561	1,292	1,240	9,802	12,150
02/02/2008 6:00	3.561	1,292	1,240	9,799	12,150
02/02/2008 7:00	3.561	1,292	1,240	9,796	12,150
02/02/2008 8:00	3.562	1,292	1,241	9,791	12,154
02/02/2008 9:00	3.562	1,291	1,241	9,795	12,153
02/02/2008 10:00	3.561	1,290	1,239	9,804	12,152
02/02/2008 11:00	3.561	1,290	1,239	9,806	12,152
02/02/2008 12:00	3.561	1,289	1,238	9,814	12,150
02/02/2008 13:00	3.561	1,288	1,237	9,823	12,151
02/02/2008 14:00	3.561	1,288	1,237	9,824	12,150
02/02/2008 15:00	3.561	1,288	1,238	9,819	12,152
02/02/2008 16:00	3.560	1,288	1,237	9,820	12,148
02/02/2008 17:00	3.561	1,288	1,238	9,812	12,151
02/02/2008 18:00	3.560	1,289	1,239	9,803	12,148
02/02/2008 19:00	3.561	1,290	1,240	9,797	12,151
02/02/2008 20:00	3.562	1,290	1,241	9,796	12,152
02/02/2008 21:00	3.562	1,290	1,240	9,802	12,153
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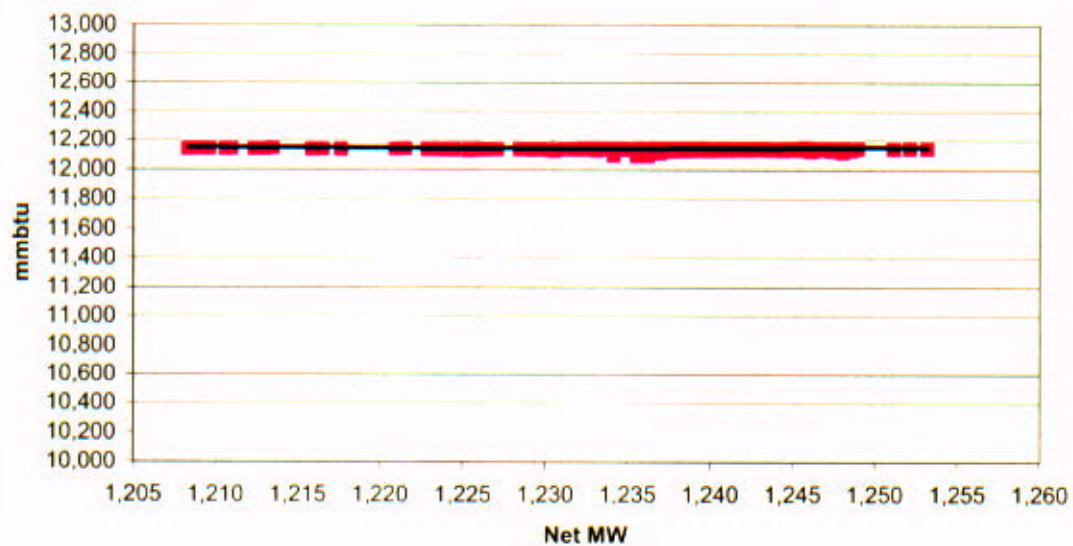
Raccoon Creek CTG #1

PI Data Period	From 08/01/2007	To 08/31/2007	
		Gross MW Raccoon 1	MMBTU Raccoon 1
	RC 1 DWATT	RC 1 HTIN	Calculated Heat Rate Btu/Kwh
01-Aug-07 00:00:00	0.0	0.0	-
01-Aug-07 01:00:00	0.0	0.0	-
01-Aug-07 02:00:00	0.0	0.0	-
01-Aug-07 03:00:00	0.0	0.0	-
01-Aug-07 04:00:00	0.0	0.0	-
01-Aug-07 05:00:00	0.0	0.0	-
01-Aug-07 06:00:00	0.0	0.0	-
01-Aug-07 07:00:00	0.0	0.0	-
01-Aug-07 08:00:00	0.0	0.0	-
01-Aug-07 09:00:00	0.0	0.0	-
01-Aug-07 10:00:00	0.0	0.0	-
01-Aug-07 11:00:00	0.0	0.0	-
01-Aug-07 12:00:00	5.3	85.9	16,068
01-Aug-07 13:00:00	62.7	798.7	12,745
01-Aug-07 14:00:00	64.7	816.6	12,617
01-Aug-07 15:00:00	70.9	880.0	12,414
01-Aug-07 16:00:00	65.7	826.4	12,579
01-Aug-07 17:00:00	6.3	119.4	18,828
01-Aug-07 18:00:00	0.0	0.0	-
01-Aug-07 19:00:00	0.0	0.0	-
01-Aug-07 20:00:00	0.0	0.0	-
01-Aug-07 21:00:00	0.0	0.0	-
01-Aug-07 22:00:00	0.0	0.0	-
01-Aug-07 23:00:00	0.0	0.0	-
02-Aug-07 00:00:00	0.0	0.0	-
02-Aug-07 01:00:00	0.0	0.0	-
02-Aug-07 02:00:00	0.0	0.0	-
02-Aug-07 03:00:00	0.0	0.0	-
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03-Aug-07 11:00:00	0.0	0.0	-
03-Aug-07 12:00:00	0.0	19.7	-
03-Aug-07 13:00:00	65.5	823.5	12,565
03-Aug-07 14:00:00	70.9	881.8	12,440
03-Aug-07 15:00:00	66.9	835.5	12,489
03-Aug-07 16:00:00	76.5	929.4	12,156
03-Aug-07 17:00:00	66.4	835.1	12,580
03-Aug-07 18:00:00	39.1	533.3	13,627
03-Aug-07 19:00:00	0.0	0.0	-
03-Aug-07 20:00:00	0.0	0.0	-
03-Aug-07 21:00:00	0.0	0.0	-
03-Aug-07 22:00:00	0.0	0.0	-
03-Aug-07 23:00:00	0.0	0.0	-

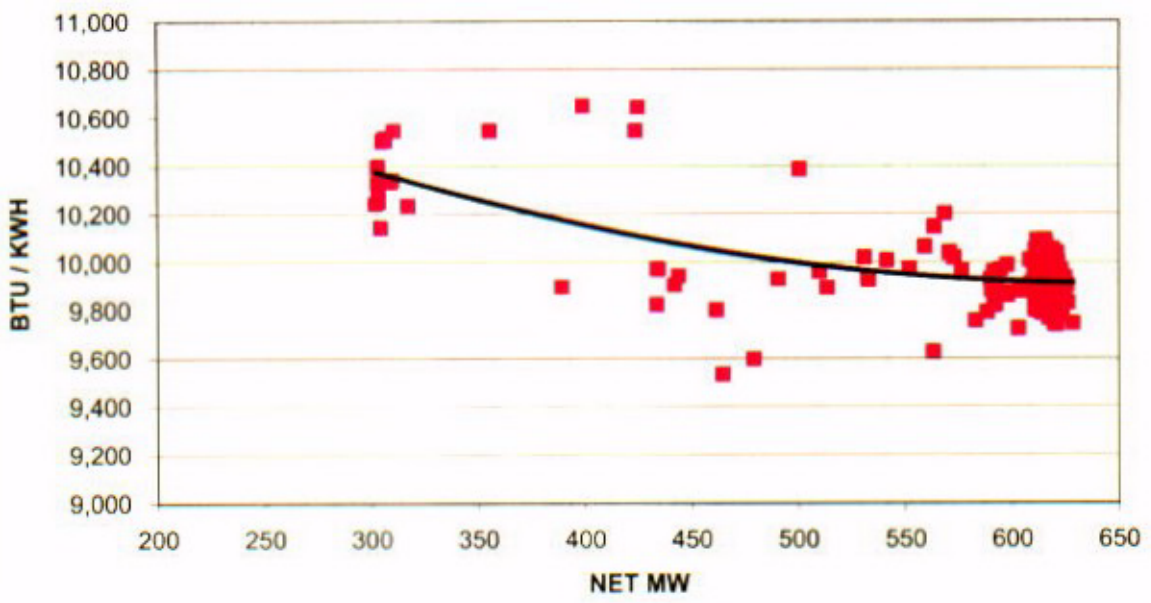
Callaway Net Heat Rate Curve February 2008



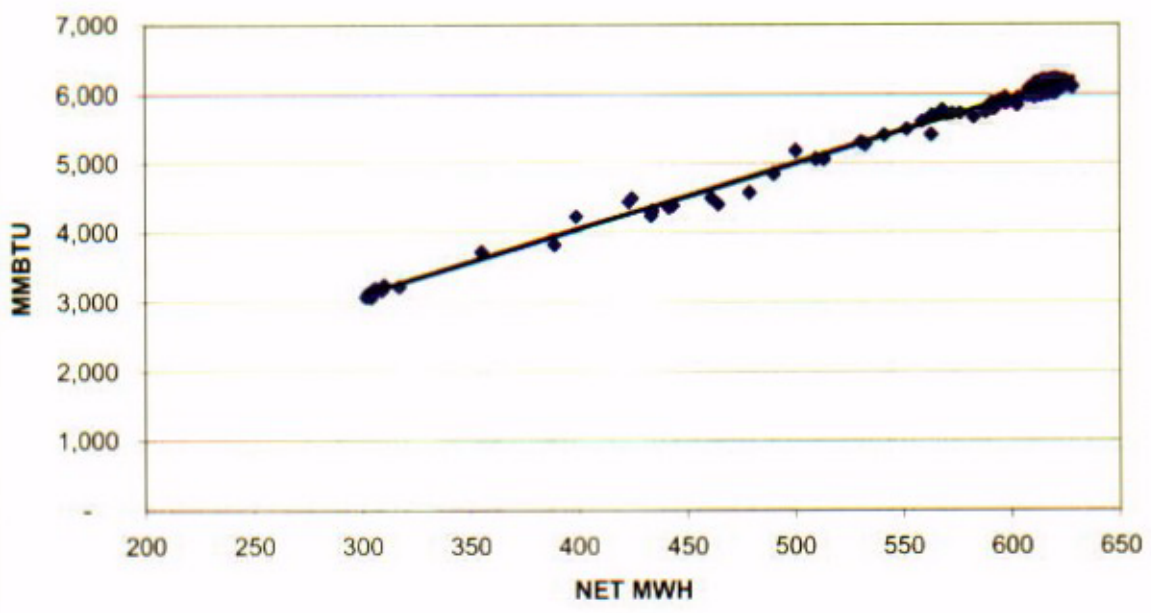
Callaway Input / Output Curve February 2008



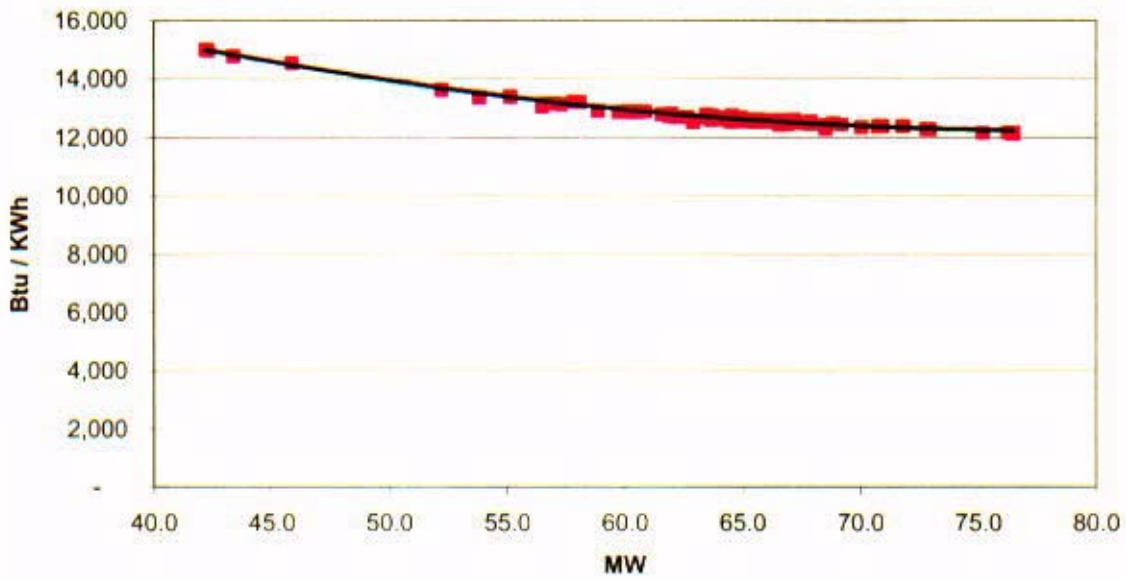
Labadie #3 Heat Rate Curve February 2008



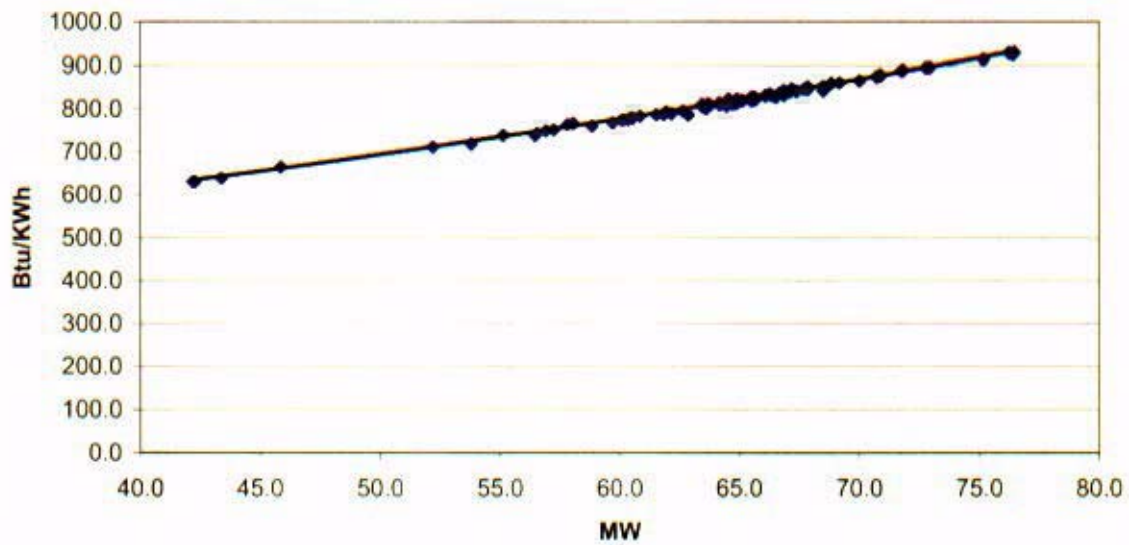
Labadie # 3 Input / Output Curve February 2008



Raccoon Creek # 1 Heat Rate Curve August 2008



Raccoon Creek #1 Input / Output Curve August 2008



Performance Monitoring Systems

Unit Name	12 Month Avg		Performance		Data Archive	2007 Net Generation	% of 2007 Annual	Baseline Heat Rate	Heat Rate Testing
	Net	Primary Fuel Type	Monitoring Systems ¹	System ¹	System ¹		Generation	Testing Date	Interval
Callaway	1,220	Nuclear	eDNA	eDNA		9,371,955	18.6%	Dec-08	12 months
Labadie 1	607	PRB Coal	EtaPRO/OPM	PI		4,604,520	9.2%	Dec-08	12 months
Labadie 2	596	PRB Coal	EtaPRO/OPM	PI		4,757,616	9.5%	Dec-08	12 months
Labadie 3	611	PRB Coal	EtaPRO/OPM	PI		4,680,336	9.3%	Dec-08	12 months
Labadie 4	611	PRB Coal	EtaPRO/OPM	PI		4,875,570	9.7%	Dec-08	12 months
Rush 1	600	PRB Coal	EtaPRO/OPM	PI		2,780,515	5.5%	Dec-08	12 months
Rush 2	592	PRB Coal	EtaPRO/OPM	PI		4,236,129	8.4%	Dec-08	12 months
Sioux 1	499	PRB /LL Coal	EtaPRO/OPM	PI		3,284,409	6.5%	Dec-08	12 months
Sioux 2	503	PRB /LL Coal	EtaPRO/OPM	PI		3,358,939	6.7%	Dec-08	12 months
Meramec 1	124	PRB Coal	EtaPRO/OPM	PI		910,461	1.8%	Dec-08	12 months
Meramec 2	125	PRB Coal	EtaPRO/OPM	PI		873,483	1.7%	Dec-08	12 months
Meramec 3	264	PRB Coal	EtaPRO	PI		1,810,654	3.6%	Dec-08	12 months
Meramec 4	355	PRB Coal	EtaPRO/OPM	PI		2,289,658	4.6%	Dec-08	12 months
Audrain CT 1	78	Gas	PI	PI		5,669	0.0%	Aug-08	12 months
Audrain CT 2	78	Gas	PI	PI		11,739	0.0%	Aug-08	12 months
Audrain CT 3	78	Gas	PI	PI		10,986	0.0%	Aug-08	12 months
Audrain CT 4	78	Gas	PI	PI		10,600	0.0%	Aug-08	12 months
Audrain CT 5	78	Gas	PI	PI		7,715	0.0%	Aug-08	12 months
Audrain CT 6	78	Gas	PI	PI		7,356	0.0%	Aug-08	12 months
Audrain CT 7	78	Gas	PI	PI		5,536	0.0%	Aug-08	12 months
Audrain CT 8	78	Gas	PI	PI		5,152	0.0%	Aug-08	12 months
Fairgrounds CT	58	Oil	---	---		471	0.0%	Aug-08	12 months
Goose Creek CT 1	76	Gas	PI	PI		21,701	0.0%	Aug-08	12 months
Goose Creek CT 2	76	Gas	PI	PI		20,563	0.0%	Aug-08	12 months
Goose Creek CT 3	76	Gas	PI	PI		21,405	0.0%	Aug-08	12 months
Goose Creek CT 4	76	Gas	PI	PI		18,663	0.0%	Aug-08	12 months
Goose Creek CT 5	76	Gas	PI	PI		19,081	0.0%	Aug-08	12 months
Goose Creek CT 6	76	Gas	PI	PI		18,467	0.0%	Aug-08	12 months
Howard Bend CT	45	Oil	---	---		22	0.0%	Aug-08	12 months
Kinmundy CT 1	110	Gas	PI	PI		8,485	0.0%	Aug-08	12 months
Kinmundy CT 2	110	Gas	PI	PI		9,218	0.0%	Aug-08	12 months
Kirksville CT	13	Gas	---	---		10	0.0%	Aug-08	12 months
Meramec CT 1	59	Oil	---	---		255	0.0%	Aug-08	12 months
Meramec CT 2	58	Gas	---	---		4,584	0.0%	Aug-08	12 months
Mexico CT	58	Oil	---	---		667	0.0%	Aug-08	12 months
Moberly CT	58	Oil	---	---		-132	0.0%	Aug-08	12 months
Moreau CT	58	Oil	---	---		-297	0.0%	Aug-08	12 months
Peno Creek CT 1	47	Gas	PI	PI		44,850	0.1%	Aug-08	12 months
Peno Creek CT 2	47	Gas	PI	PI		42,382	0.1%	Aug-08	12 months
Peno Creek CT 3	47	Gas	PI	PI		43,010	0.1%	Aug-08	12 months
Peno Creek CT 4	47	Gas	PI	PI		39,002	0.1%	Aug-08	12 months
Pinkneyville CT 1	40	Gas	PI	PI		36,147	0.1%	Aug-08	12 months
Pinkneyville CT 2	40	Gas	PI	PI		40,454	0.1%	Aug-08	12 months
Pinkneyville CT 3	40	Gas	PI	PI		40,020	0.1%	Aug-08	12 months
Pinkneyville CT 4	40	Gas	PI	PI		39,156	0.1%	Aug-08	12 months
Pinkneyville CT 5	37	Gas	PI	PI		2,733	0.0%	Aug-08	12 months
Pinkneyville CT 6	37	Gas	PI	PI		3,204	0.0%	Aug-08	12 months
Pinkneyville CT 7	37	Gas	PI	PI		2,741	0.0%	Aug-08	12 months
Pinkneyville CT 8	37	Gas	PI	PI		2,728	0.0%	Aug-08	12 months
Raccoon Creek CT 1	78	Gas	PI	PI		15,170	0.0%	Aug-08	12 months
Raccoon Creek CT 2	78	Gas	PI	PI		13,631	0.0%	Aug-08	12 months
Raccoon Creek CT 3	78	Gas	PI	PI		10,073	0.0%	Aug-08	12 months
Raccoon Creek CT 4	78	Gas	PI	PI		10,326	0.0%	Aug-08	12 months
Venice CT 1	27	Oil	---	---		0	0.0%	Aug-08	12 months
Venice CT 2	50	Gas	PI	PI		39,095	0.1%	Aug-08	12 months
Venice CT 3	173	Gas	PI	PI		111,798	0.2%	Aug-08	12 months
Venice CT 4	173	Gas	PI	PI		126,410	0.3%	Aug-08	12 months
Venice CT 5	110	Gas	PI	PI		20,778	0.0%	Aug-08	12 months
Viaduct CTG	27	Gas	---	---		0	0.0%	Aug-08	12 months
Osage	234					652,891	1.3%		
Keokuk	130					942,357	1.9%		
Taum Sauk	440					0	0.0%		
Totals	10,586					50,321,117			

Nuclear and Fossil

Steam, CTG

Generation without

Performance

Monitors

% of Total

Generation

5,580

0.01%

Note: 1 eDNA is a product of InStep Software, LLC
 EtaPRO is a product of the General Physics Corporation
 OPM is a product of Black & Veatch
 PI is a product of OSisoft, Inc.

CALLAWAY PLANT
ENGINEERING TECHNICAL PROCEDURE
ETP-ZZ-01101
PLANT DERATES AND EFFICIENCIES

This procedure contains the following:

Pages	<u>1</u>	through	<u>6</u>
Attachments	<u>1</u>	through	<u>2</u>
Tables	<u> </u>	through	<u> </u>
Figures	<u> </u>	through	<u> </u>
Appendices	<u> </u>	through	<u> </u>
Checkoff Lists	<u> </u>	through	<u> </u>
This procedure has	<u> </u>	checkoff list(s) maintained in the mainframe computer.	

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6	REFERENCES	5
7	RECORDS.....	5
8	SUMMARY OF CHANGES	6
Attachment 1	Secondary Thermal Performance Daily Status Report	2 Pages
Attachment 2	Calculation Description	5 Pages

PLANT DERATES AND EFFICIENCIES

1 PURPOSE AND SCOPE

1.1 PURPOSE

1.1.1 This procedure provides guidelines for the collection, calculation, and trending of performance parameters for the plant derates and efficiencies and determining when further investigation and/or corrective actions are needed to optimize plant performance.

1.1.2 This procedure is a guideline. Deviation is permissible by the Secondary Thermal Performance Engineer, to enhance its intended purpose.

1.2 SCOPE

1.2.1 This procedure monitors the following plant performance parameters:

- Carnot Efficiency
- Rankine Efficiency
- Thermal Efficiency
- Gross Heat Rate
- Net Heat Rate
- Condenser Backpressure MWe Effect
- Ambient Conditions MWe Effect
- Condenser MWe Effect
- Cooling Tower MWe Effect
- Design Point Deviation
- Feedwater/Main Steam Mismatch Derate
- Other Losses
- Power Level Derate
- Steam Generator Blowdown Derate

1.2.2 This procedure is performed on a frequency determined by the Secondary Thermal Performance Engineer as needed to adequately follow plant performance.

Schedule MCB-E4-3

2 DEFINITIONS

- 2.1 Carnot Efficiency (η_{CAR}) is the theoretical standard for power cycles and is solely a function of the high- and low-temperature reservoirs. Expressed as a percentage.
- 2.2 Rankine Efficiency (η_{RANK}) is the ideal standard of power plant power cycles that does not take into account inefficiencies of the pumps and turbines. Expressed as a percentage.
- 2.3 Thermal Efficiency (η_{th}) is defined as the ratio of total power output of the cycle to the total power input and is expressed as a percentage.
- 2.4 Gross Heat Rate (GHR) is defined as the ratio of total thermal energy produced by the reactor core to the total gross electrical energy produced by the generator and is expressed in BTU/KW-Hr.
- 2.5 Net Heat Rate (NHR) is defined as the ratio of total thermal energy produced by the reactor core to the total net electrical energy produced by the generator and is expressed in BTU/KW-Hr.
- 2.6 Condenser Backpressure MWe Effect is the electrical effect due to measured condenser backpressures not being at design values. If the condenser backpressure is below design, a gain in electrical output WILL be realized. If the condenser backpressure is above design, a loss in electrical output WILL be realized. The total condenser backpressure MWe effect is equal to the summation of ambient conditions deviation, condenser performance, and cooling tower performance.
- 2.7 Ambient Conditions MWe Effect is the electrical effect due to ambient conditions differing from design such that the expected cooling tower outlet temperature differs from design of 80°F. A lower expected cooling tower outlet temperature would indicate a gain in electrical output while a higher expected cooling tower would indicate a loss in electrical output.

- 2.8 Condenser MWe Effect is the electrical effect due to the expected condenser backpressures differing from the measured condenser backpressures. An expected condenser backpressure lower than the measured condenser backpressure would indicate a loss in electrical output. An expected condenser backpressure higher than the measured condenser backpressure would indicate a gain in electrical output.
- 2.9 Cooling Tower MWe Effect is the electrical effect due to the expected cooling tower outlet temperature differing from the measured cooling tower outlet temperature. An expected cooling tower outlet temperature lower than the measured cooling tower outlet temperature would indicate a loss in electrical output. An expected cooling tower outlet temperature higher than the measured cooling tower outlet temperature would indicate a gain in electrical output.
- 2.10 Design Point Deviation is an indication of how well all adjustments made account for deviation from design conditions. Design point deviation is expressed both as a percentage of rated electrical output and MWe.
- 2.11 Other Losses are the losses due to miscellaneous condenser isolation problems (i.e., leaking valves). Expressed in MWe.
- 2.12 Power Level Derate is an adjustment made to account for the plant not operating at 100% power. Expressed in MWe.
- 2.13 Feedwater/Main Steam Mismatch Derate is an adjustment for when using feedwater calorimetric and feedwater/main steam flow mismatch is negative. It shows that there is a potential for higher electrical output by switching to main steam calorimetric.
- 2.14 Steam Generator Blowdown Derate is an adjustment for the electrical loss due to using steam generator blowdown. Expressed in MWe.

3 RESPONSIBILITIES

3.1 SECONDARY THERMAL PERFORMANCE ENGINEER

- 3.1.1 The Secondary Thermal Performance Engineer is responsible for the implementation of this procedure.
- 3.1.2 The Secondary Thermal Performance Engineer is responsible for making recommendations for corrective actions and/or further testing based on the results of this procedure.

4 INITIAL CONDITIONS

- 4.1 It should be verified that the plant is operating in a stable and normal condition. If plant conditions are not stable or normal, data may still be collected, but the nature of the transient or abnormality should be noted. (i.e., Power increasing 5%/hr, Operating two circulating water pumps, etc.)

5 INSTRUCTIONS

- 5.1 Data required per the majority of this procedure is covered by ETP-AD-01100, Condenser Performance Monitoring, ETP-BB-01100, Steam Generator Performance Monitoring and ETP-DA-01100, Circulating Water System Performance Monitoring.
- 5.2 Record data required by ETP-BB-01100, ETP-AD-01100, and ETP-DA-01100. This data may be obtained from local gauges, special test instrumentation, computer points, control room indications and/or Operations' daily logs, if data is obtained within a reasonable time frame.
- 5.3 Calculate performance parameters listed in ETP-BB-01100, ETP-AD-01100, and ETP-DA-01100 per the procedures.
- 5.4 Using the parameters calculated in step 5.3 calculate performance parameters shown on Attachment 1, Secondary Thermal Performance Daily Status Report per Attachment 2, Calculation Description.

- 5.5 Make copies of the Secondary Thermal Performance Daily Status Report and distribute per designated distribution list. (Minimal distribution is the Secondary Thermal Performance Engineer and the Thermal Performance Supervising Engineer.
- 5.6 Plot the performance parameters from step 5.4 versus time and review for unexpected sudden changes and/or gradual trends.
- 5.7 If unexpected changes and/or gradual adverse trends are discovered, the Performance Engineer should initiate a corrective action document.
- 5.8 Any unexpected changes or gradual trends should be discussed with the appropriate System Engineer.

6 REFERENCES

- 6.1 EDP-ZZ-01110, Predictive Performance Program
- 6.2 EDP-ZZ-01116, Secondary Thermal Performance, Predictive Performance Manual
- 6.3 ETP-BB-01100, Steam Generator Performance Monitoring
- 6.4 ETP-DA-01100, Circulating Water System Performance Monitoring
- 6.5 ETP-AD-01100, Condenser Performance Monitoring

7 RECORDS

- 7.1 Commercial Records
 - 7.1.1 Attachment 1 (File E170.0200, Daily Status Summary)
 - 7.1.2 Trending Plots (File E170.0335, Plant Derates and Efficiencies)

8 SUMMARY OF CHANGES

Page(s) Section or Step
 Number Description

Page(s)	Section or Step Number	Description
	1.2.1, 2.0	Deleted FW Inlet Temp, Reduced MN STM Press and Capacity Factors
	5.0	Deleted Test Equip
	ATT 2	Deleted 1.11 FW inlet temp and 1.17 capacity factors
		Various minor rewording og steps throught procedure and attachment. changes per CAR 200407886 action 4

SECONDARY THERMAL PERFORMANCE
DAILY STATUS REPORT

DATE: _____

GENERATOR GROSS ELECTRICAL OUTPUT _____ MWe
HOUSE ELECTRICAL LOADS _____ MWe
NET STATION OUTPUT _____ MWe
THERMAL POWER _____ MWt
 PERCENT OF FULL RATED POWER (3565 MWt) _____ %
UNIT THERMAL EFFICIENCY _____ %
 STATION GROSS HEAT RATE _____ BTU/kWH
 STATION NET HEAT RATE _____ BTU/kWH

ALSTOM HEAT BALANCE RATING 1284.1 MWe

UNIT DERATINGS:

DUE TO PRIMARY CONDITIONS:

NSSS POWER LEVEL _____ MWe

DUE TO SECONDARY CONDITIONS:

S. G. BLOWDOWN _____ MWe

CONDENSER BACKPRESSURES: _____ MWe

LP CONDENSER _____ INHA (_ MWe)

IP CONDENSER _____ INHA (_ MWe)

HIP CONDENSER _____ INHA (_ MWe)

AMBIENT CONDITIONS EFFECT _____ MWe

CONDENSER EFFECT _____ MWe

COOLING TOWER EFFECT _____ MWe

FW/MS MISMATCH (_____ KLBH) EFFECT _____ MWe

OTHER LOSSES (LISTED ON PAGE 2) _____ MWe

DESIGN POINT DEVIATION (_____ % OF 1284.1) _____ MWe

GROSS ELECTRICAL OUTPUT _____ MWe

COMMENTS: _____

SECONDARY THERMAL PERFORMANCE
DAILY STATUS REPORT

DATE: _____

OTS-ZZ-00005 RESULTS:

JOB #	VALVE ID #	MWe LOSS
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
	TOTAL	_____ MWe

COMMENTS: _____

1.0 Calculation Description

1.1 Nomenclature

CCF	Cycle Capacity Factor, %
DCF	Daily Capacity Factor, %
GHR	Gross Heat Rate, BTU/kW-hr
LCF	Life Capacity Factor, %
MCF	Monthly Capacity Factor, %
MW _a	Actual Electrical Generation, MW _e
MW _p	Projected Electrical Generation, MW _e
NHR	Net Heat Rate, BTU/kW-hr
NSSS	Nuclear Steam Supply System Power Level, %
Q _{in}	Total Steam Generator Heat Transfer Rate, BTU/hr
Q _{out}	Total Condenser Heat Transfer Rate, BTU/hr
T _H	Heat Source Reservoir (Steam Generator) Temperature, °R
T _L	Heat Sink Reservoir (Cooling Tower) Temperature, °R
η _{CAR}	Carnot Efficiency, %
η _{RANK}	Rankine Efficiency, %
η _{th}	Unit Thermal Efficiency, %

1.2 Carnot Efficiency (η_{CAR}, %)

$$\eta_{CAR} = (1 - T_L / T_H) 100\%$$

Where:

T_L DAT0049 LP Condenser Right Side Circulating Water Inlet Temperature
DAT0050 LP Condenser Left Side Circulating Water Inlet Temperature
converted to absolute temperature (°R)

T_H Average steam generator saturation temperature converted to absolute
temperature (°R) (as calculated in ETP-BB-01100, Steam Generator (SG)

Performance Monitoring)

1.3 Rankine Efficiency (η_{RANK}, %)

$$\eta_{RANK} = (1 - Q_{in} / Q_{out}) 100\%$$

Where:

Q_{in} Total SG heat transfer rate (BTU/hr) (as calculated in ETP-BB-01100)

Q_{out} Total condenser heat transfer rate (BTU/hr) (as calculated in
ETP-AD-01100, Condenser Performance Monitoring)

1.4 Thermal Efficiency (η_{th} , %)

$$\eta_{th} = (\text{MAJ0001} / \text{Total NSSS thermal power})$$

Where:

MAJ0001 Main Generator Power

Total NSSS thermal power (as calculated in ETP-BB-01100)

1.5 Gross Heat Rate (GHR, BTU/kW-hr)

$$\text{GHR} = (\text{RJU0229} / \text{RJJ0151}) 3412.14 \text{ BTU/kW-hr}$$

Where:

RJJ0151 Gross Generation Hour Average

RJU0229 Reactor Total Thermal Power Hour Average

1.6 Net Heat Rate (NHR, BTU/kW-hr)

$$\text{NHR} = (\text{RJU0229} / (\text{RJJ0151} - \text{MAI0104})) 3412.14 \text{ BTU/kW-hr}$$

Where:

RJJ0151 Gross Generation Hour Average

RJU0229 Reactor Total Thermal Power Hour Average

MAI0104 House Loads

1.7 Condenser Backpressure MW_e Effect

- 1.7.1 Using measured condenser backpressures, throttle flow and Alstom Condenser Output Correction Curve at 100% power, drawing 75V1741, calculate the percentage change in kilowatt load and apply to base of 1284.1 MWe.

ACP0204 LP Turbine A Exhaust Pressure

ACP0211 LP Turbine B Exhaust Pressure

ACP0218 LP Turbine C Exhaust Pressure

- 1.8 Ambient Conditions MW_e Effect
 - 1.8.1 Using the expected cooling tower outlet temperature and circulating water flow rate (gpm) (as calculated in ETP-DA-01100, Circulating Water System Performance Monitoring), heat transfer rate (MBTU/hr) (as calculated in ETP-AD-01100) and condenser vendor manual M-1188-00041 Performance Curves, establish expected condenser backpressures for the calculated expected cooling tower outlet temperature.
 - 1.8.2 Using calculated condenser backpressures from step 1.8.1 and Alstom Condenser Output Correction Curve at 100% power, drawing 75V1741, calculate the percentage change in kilowatt load and apply to 1284.1 MW_e .
- 1.9 Condenser MW_e Effect
 - 1.9.1 Using the measured circulating water inlet temperature and circulating water flow rate (gpm) (as calculated in ETP-DA-01100), heat transfer rate (MBTU/hr) (as calculated in ETP-AD-01100) and condenser vendor manual M-1188-00041, establish expected condenser backpressures for the measured circulating water inlet temperature.

DAT0049 LP Condenser Right Side Circulating Water Inlet Temperature
DAT0050 LP Condenser Left Side Circulating Water Inlet Temperature
 - 1.9.2 Using calculated condenser backpressures from step 1.9.1 and Alstom Condenser Output Correction Curve at 100% power, drawing 75V1741, calculate the percentage change in kilowatt load and apply to 1284.1 MW_e .
 - 1.9.3 The difference of the condenser MW_e effect calculated in step 1.7.1 and the MW_e effect calculated in step 1.9.2 is the condenser MW_e effect.
- 1.10 Cooling Tower MW_e Effect
 - 1.10.1 The cooling tower MW_e effect is equal to the difference between the MW_e effect calculated in step 1.9.2 and the ambient conditions MW_e effect calculated in step 1.8.2.

1.11 Feedwater/Main Steam Mismatch (KLBH)

Mismatch = Total SG Main Steam Flow + Total SG Blowdown Flow - Total SG Feedwater Flow

1.11.1 The total main steam flow rate is based on:

REU0413 Loop A SG Corrected Main Steam Flow
REU0433 Loop B SG Corrected Main Steam Flow
REU0453 Loop C SG Corrected Main Steam Flow
REU0473 Loop D SG Corrected Main Steam Flow

1.11.2 The total SG Blowdown flow rate is based on:

REU0701 SG Blowdown Non-Regenerative Heat Exchange Water Flow
REU0703 SG Blowdown Flash Tank Steam Flow

1.11.3 The total feedwater flow rate is based on:

REU0411 Loop A SG Corrected Feedwater Flow
REU0431 Loop B SG Corrected Feedwater Flow
REU0451 Loop C SG Corrected Feedwater Flow
REU0471 Loop D SG Corrected Feedwater Flow

1.12 Feedwater/Main Steam Mismatch Derate

The feedwater/main steam mismatch derate is equal to the average enthalpy rise (as calculated in ETP-BB-01100) multiplied by the feedwater/main steam mismatch (as calculated in step 1.11) multiplied by the unit thermal efficiency (as calculated in step 1.4) divided by 3412.14 BTU/kW-hr.

1.13 Other Loses

Other losses are calculated on an as needed basis determined as necessary from results of OTS-ZZ-00005, Thermal Loss Rounds For Secondary System Equipment.

1.14 Power Level Derate

Electrical Output
NSSS Power

Power level derate = (NSSS power – 3579) x

1.14.1 The Power Level Derate is the difference between NSSS thermal power and rated power (3579 MWt) multiplied by unit thermal efficiency (as calculated in step 1.4)

1.15 Steam Generator Blowdown Derate

The SG blowdown derate will depend on whether or not the SG blowdown regenerative heat exchanger is in service. Step 1.15.1 will cover when the regenerative heat exchanger is in service and step 1.15.2 for when

1.15.1 The SG blowdown derate is equal to the SG blowdown regenerative heat exchanger outlet enthalpy multiplied by SG flash tank water flow multiplied by unit thermal efficiency (as calculated in step 1.4) divided by 3412.14 BTU/kW-hr.

1.15.1.1 The SG blowdown regenerative heat exchanger outlet enthalpy is based on:

BMTI0057 SG Blowdown Regenerative Heat Exchanger Discharge Temperature

1.15.1.2 The SG flash tank water flow is based on:

REU0701 SG Blowdown Heat Exchangers Outlet Header Flow

1.15.2 The SG blowdown derate is equal to the SG flash tank water outlet enthalpy multiplied by SG flash tank water flow multiplied by unit thermal efficiency (as calculated in step 1.4) divided by 3412.14 BTU/kW-hr.

1.15.2.1 The SG flash tank outlet enthalpy is based on:

REY9056A SG Blowdown Flash Tank Pressure

1.15.2.2 The SG flash tank water flow is based on:

REU0701 SG Blowdown Heat Exchangers Outlet Header Flow

Performance Reporting for AmerenUE Combustion Turbine Generators

Intent of Report

The purpose of this report is to establish a standardized method for calculating and reporting a combustion turbine generators (CTG) performance for a specific time period. Establishing a standardized performance report will allow a generating unit's performance to be tracked over time. The report will be based on actual unit operating data and will include heat rate, power, fuel flow and sufficient operating data validating the calculated values. Recognizing that the CTG heat rate varies with load, ambient conditions, power augmentation equipment status and fuel gas temperatures, the operating data will be filtered and compensated and finally averaged over a specific time period.

There are operating and dispatching scenarios wherein it may be difficult to obtain actual data. On units which have a very low dispatch frequency, units shall not be dispatched for the single purpose of performing calculations. Also, the Midwest Independent Transmission System Operator (MISO) dispatch often requires certain CTGs to follow area load signals and consequently may result in inefficient operations. Under these circumstances, engineering discretion will be necessary to validate the data. MISO's dispatch shall not be altered for the single purpose of performing calculations.

General

AmerenUE Power Operation Services (POS) will be responsible for preparing the CTG performance report. The performance report will be produced utilizing data values and calculated values obtained from the individual CTG OSI PI (PI) server archives, which store CTG operational data. The Microsoft Excel Add-In PI DataLink will be used to retrieve, filter and statistically analyze the data.

A calendar month of data will be used to produce the CTG performance report. Operating conditions such as load fluctuations and variable ambient conditions affecting unit output or heat rate will be compensated or filtered from the average.

Data Retrieval and Filtering and Validation

The data collected will be "hourly averaged" data for all raw data and calculated data from the performance monitoring system. The time stamp "HE= 01:00" will be the average for the time from 00:00 to 01:00 and the data set will be named "Data Import". All of the original data retrieved for the period will be retained in the "Data Import" data set.

Data filtering will be used to remove certain types of data. The first data filter will be to remove data when the unit load was less than 60% of its nominal full load capacity and hours in which the performance monitor results are flagged as "bad quality" or are blank.

The nominal full load capability will be the monthly full load rating listed in the Annual Unit Capability Report. The load data is limited to loads 60% or greater because this load range represents the normal operating range for the CTG units. Load levels below 60% represent unit start-ups and shutdowns, as well as unusual operating conditions. A new data set will be created using this first filter and will be named "MW GT 60% and No Bad Quality". This new data set will be retained and used to produce a preliminary input/output curve and heat rate vs. load curve for the report period. Microsoft Excel will be used to produce a least squares regression through the data points of the input / output curve. The regression results for the input / output curve will be used to produce a heat rate vs. load curve.

A second filtering will be done by the POS performance engineer. The POS performance engineer will review the curves and data points and determine if any data point outliers should be removed. If data points are removed, the reason for their removal will be documented. If data points are removed, a revised data set "MW > 60% and No Bad Quality" will be created along with a revised input/output curve and a revised heat rate vs. load curve.

The third level of filtering will be used to produce a set of data which represents full load operations. Full load operations is achieved when the turbine exit gas temperatures are at designed levels and the unit is operating at a stable load level. The new data set with full load operations will be created and named "All Full Load".

The POS performance engineer will review the "All Full Load" data set and determine if any of the data points should be removed. If data points are removed, the reason for their removal will be documented. The remaining data will be trended over the reporting time period. Any additional data points that appear to be outliers will be reviewed by the POS performance engineer. Invalid data will be removed and explanation for the removal will be documented. A new "All Full Load" data set will be created with the remaining data.

Reporting

A performance report will be published which contains the following: input / output curve showing fuel input vs. gross load, heat rate curve showing gross heat rate vs. gross load, and a full load heat rate report, which contains full load reporting data such as: gross heat rate at full load, ambient temperature, barometric pressure, relative humidity, compressor discharge pressure and exit gas temperature.

Performance Reporting for AmerenUE Fossil Steam Generating Units

Intent of Report

The purpose of this report is to establish a standardized method for calculating and reporting a generating unit's performance for a specific time period. Establishing a standardized performance report will allow a generating unit's performance to be tracked over time. The term "performance" refers to a generating unit's net heat rate and components or parameters which have an effect on net heat rate, such as turbine and boiler efficiency, auxiliary power, etc. The report will be based on actual unit operations for a specified time period as opposed to data collected for a short time period under test conditions (auxiliary flows minimized, cycle verified isolated as well as possible, fuel and turbine in manual control, etc.)

General

AmerenUE Power Operation Services (POS) will be responsible for preparing the generating unit performance report. The performance report will be produced utilizing data and calculated values obtained from the individual plants OSI PI (PI) server archives. The PI server archives store generating unit operational data as well as calculated data from the performance monitoring system. Performance monitoring systems calculate performance metrics such as unit net heat rate, turbine efficiency and boiler efficiency using principal mass and energy balances or methods described in American Society of Mechanical Engineers Power Test Code 4 and 6 (ASME PTC 4 and 6). The Microsoft Excel Add-In PI DataLink will be used to retrieve, filter and statistically analyze the data. A calendar month's of data will be used to produce the performance report.

Data Retrieval and Filtering and Validation

The data collected will be "hourly averaged" data for all raw data and calculated data from the performance monitoring system. The time stamp "HE= 01:00" will be the average for the time from 00:00 to 01:00 and the data set will be named "Data Import". All of the original data retrieved for the period will be retained in the "Data Import" data set.

Data filtering will be used to remove certain types of data. The first data filter will be to remove data when the unit load was less than 40% of its nominal full load capacity and hours in which the performance monitor results are flagged as "bad quality" or are blank. The nominal full load capability will be the monthly full load rating listed in the Annual Unit Capability Report. The load data is limited to loads 40% or greater because this load range represents the normal operating range for the coal units. Load levels below 40% represent unit start-ups and shutdowns, as well as unusual operating conditions. A new data set will be created using this first filter and will be named "MW GT 40% and No Bad Quality". This new data set will be retained and used to produce a preliminary input/output curve and heat rate vs. load curve for the report period. Microsoft Excel will be used to produce a least squares regression through the data points of the input / output curve. The regression results for the input / output curve will be used to produce a heat rate vs. load curve.

A second filtering will be done by the POS performance engineer. The POS performance engineer will review the curves and data points and determine if any data point outliers should be removed. If data

points are removed, the reason for their removal will be documented. If data points are removed, a revised data set "MW > 40% and No Bad Quality" will be created along with a revised input/output curve and a revised heat rate vs. load curve.

The third level of filtering will be used to produce a set of data which represents full load operations. Full load operations is defined to be 95% of nominal full load operations for units that do not have turbine control valve or governing valve indicators and 98% full open position for units that do have turbine control valve or governing valve indicators. All data not meeting these criteria will be eliminated and the new data set will be created and named "All Full Load".

The POS performance engineer will review the "All Full Load" data set and determine if any of the data points should be removed. If data points are removed, the reason for their removal will be documented. The remaining data will be trended over the reporting time period. Any additional data points that appear to be outliers will be reviewed by the POS performance engineer. Invalid data will be removed and explanation for the removal will be documented. A new "All Full Load" data set will be created with the remaining data.

Reporting

A performance report (See Attachemnt 1) will be published which contains the following: input / output curve showing fuel input vs. net load, heat rate curve showing net heat rate vs. net load, and a full load heat rate report, which contains full load reporting data such as: gross load, net load, gross heat rate, net heat rate, auxiliary power, boiler efficiency, turbine efficiency, control valve position, ambient air temperature, and condenser back pressure.

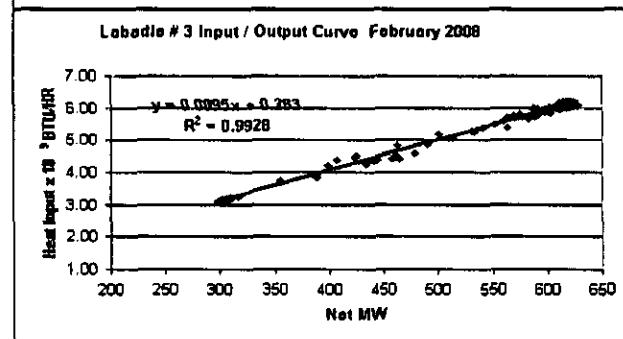
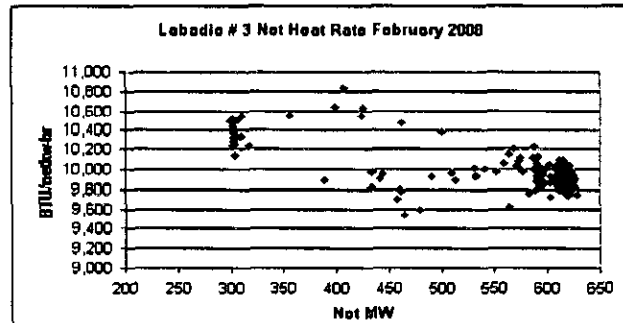
Summary of Performance Report for:

Plant Unit Labadie
 3
 Period 2/1/08 to 3/1/08

Full Load Performance

Hours of Date 637

			Averages
GENERATOR	MEGAWATTS	MW	645.2647
AUX POWER		MW	29.19414
Net Unit Heat Rate Actual (GPH)		Btu/kWh	9935.668
Net Unit Heat Rate Target		Btu/kWh	9809.271
Boiler Efficiency Actual		%	85.26794
CONTROL VALVE POSMON LVDT		%	101.8217
FEEDWATER TEMP TO ECON		DEG F	487.2217
FEEDWATER TEMP TO HTR 1		DEG F	438.329
HP Turbine Efficiency Actual		%	87.01158
IP Turbine Efficiency Corrected		%	93.94476
Condenser Pressure HP		inHga	2.234171
Condenser Pressure LP		inHga	2.272341
AIRHTR-A GAS OUTLET TEMP		DEG F	321.16
AIRHTR-B GAS OUTLET TEMP		DEG F	304.2183
AMBIENT AIR TEMP		DEG F	34.22018
CIRC WTR TEMP TO LP CONDB		DEG F	37.30889
CIRC WTR TEMP TO LP CONDB		DEG F	37.74568
Tag not found		DEG F	37.23145
CIRC WTR TEMP TO LP CONDB		DEG F	36.62323
min river temp		DEG F	36.22638
FWH 1 Trise		DEG F	48.89282
Net Load		MW	618.0705
Average Cond Press		inHga	2.253258
Average EGT		DEG F	312.6891
Aux Power		%	4.524589
Gross Unit Heat Rate		Btu/kWh	9486.123
Gross Turbine Heat Rate		Btu/kWh	8068.594
Heat Input		x 10 ⁹ btu/hr	6.120952



Performance Reporting for AmerenUE Generating Units Without Performance Monitoring Systems

Intent of Report

The purpose of this report is to establish a standardized method for calculating and reporting a generating unit's performance for a specific time period for units without a performance monitoring system. The term "performance" refers to a generating unit's heat rate.

General

The following units do not currently have performance monitoring systems:

Meramec CTG #1 and CTG #2, Fairgrounds CTG, Howard Bend CTG, Kirksville CTG, Mexico CTG, Moberly CTG, Moreau CTG, Venice #1 CTG, and Viaduct CTG

The heat rate for units without a performance monitoring system will be calculated by using accounting data using the following formula:

$$\text{Heat Rate} = (\text{Units of fuel consumed} \times \text{Btu/ unit of fuel}) / \text{unit generation.}$$

For example: a CTG that burns 7,400 gallons of oil for the month, where the heat content of the oil is 137,000 Btu / gallon, and where the monthly generation is 7,500 MWh (7,500,000 KWh), the heat rate is 13,517 Btu/kWh.