PACIFICORP ENERGY
A DIVISION OF PACIFICORP

Fossil Fuel Heat Rate Improvement Plan

PCorp_2012_HRIP

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1. Revision History

Version	Status	Author	Reason for Issue	Date
1		Alan Jackson	Sample	August 15, 2011
2		Bernard Hall	Sample Updated	November 21, 2011
3		Bernard Hall	Sample Updated	February 1, 2012
4		Bernard Hall	Draft of Final Report	March 8, 2012
5		Bernard Hall	Draft of Final Report	April 12, 2012
6		Bernard Hall	Final Report	April 30, 2012

2. Revision Control

This document is maintained by the PacifiCorp Energy Asset Management group.

3. Glossary of Terms

3.1. Actual Net Heat Rate (Btu/kWh)

Total actual heat input in Btu's divided by actual net generation.

3.2. As-built Net Heat Rate (Btu/kWh)

Total guaranteed heat input, from the design heat balances in Btu's divided by the guaranteed net generation, corrected for changes in equipment from design. This is the baseline number for the plant personnel when they make their annual reconciliation.

3.3. British thermal unit (Btu)

British thermal unit is defined as the amount of heat required to raise the temperature of one pound of water at 39.2 degrees Fahrenheit by one degree.

3.4. Fossil fuel

Fossil fuel is hydrocarbon based substance formed by the anaerobic decomposition of buried dead organisms. Typically, the substance is thousands to millions of years old. At PacifiCorp, this includes coal, oil and gas.

3.5. Gross Heat Rate (Btu/kWh)

Total actual heat input in Btu's divided by actual gross generation.

3.6. Heat Rate Index

Heat Rate Index is defined as the heat rate, as the designer planned, divided by the heat rate actually measured. The designers planned heat rate is determined from a computer model corrected to the actual boundary conditions, such as actual unit load, ambient air temperature, and condenser back-pressure.

3.7. Net Generation (kWh)

Net generation is equal to gross generation measured at the generator terminals minus parasitic power station usage.

3.8. Planned Net Heat Rate (Btu/kWh)

Total budgeted heat input in Btu's divided by the budgeted net generation. This number is the annual goal for the plant personnel to achieve.

4. Acronyms

Btu	British thermal unit
FERC	Federal Energy Regulatory Commission
FF	Fossil Fuel
HRIP	Heat Rate Improvement Plan
IRP	Integrated Resource Plan
KWh	Kilowatt hour
MW	Megawatt

5. Overall Plan and Objectives

The overall heat rate strategy is to minimize heat rate losses in our operating plants by:

- ✓ seeking areas of design changes to improve unit heat rate
- ✓ improve unit availability so units may run at increased load and reduced start-ups (better heat rate)
- ✓ focus on plant areas of principle heat rate effects
- ✓ additional training for plant engineers regarding heat rate
- ✓ add new generation resources that have improved heat rates.

This goal of improving system heat rate will be met by the activities outlined in the following sections.

5.1. Turbine Upgrades

Improve PacifiCorp Energy overall system heat rate by replacement of major turbine components. Technology improvements in turbine steam path design should result in 1-3% more generated megawatts for the same amount of steam energy supplied. No changes to the boiler capacity, fuel consumed, or stack emissions are expected. These replacements are economical on the larger units, generally those over 350 MW. Turbine replacements will be done on the regular turbine / boiler outage cycle by unit.

5.2. Boiler improvements

With the newer, more economical, gas units on line; and the lower cost of natural gas; the coal units are not loaded, or dispatched, as heavily as in past years. The older design coal boilers were designed to operate at a high capacity factor. These units often have difficulty performing efficiently at lower loads and therefore, improvements are planned to overcome this weakness.

5.3. Plant Improvements

Plant personnel continually look for changes in the original plant design that will improve the unit efficiency by reducing heat rate. This is an ongoing philosophy that exists in our plant personnel that regularly provides new ideas for improving unit efficiency that are always evaluated to determine the best investment rate of return.

5.4. Availability Improvements

Increase in unit availability and reduction of forced outages will contribute to fewer unit start-ups (less wasted energy), less low load operation (higher heat rate), and less offline fuel use and offline electrical power use. This will affect overall annual system heat rate less than 0.5 %.

Although recovery of heat rate losses due to normal wear and tear of plant components are accomplished on planned 4-year overhauls, this heat rate improvement is not considered in PacifiCorps HRIP. This cycle of heat rate loss and periodic recovery from equipment refurbishment is unit specific, dependant on overhaul cycles, and as such does not appear as a separate line item in this plan. This plan considers modification/changes in equipment from the designers original plan.

5.5. New Resources (Addressed in IRP)

Future generation needs are expected to be met with natural gas fired units. Many coal fired units are already operating near their capacity, so any increase in demand will be provided by relying on the newer gas fired units.

5.6. Retirement of Resources (Addressed in IRP)

While specific retirement dates are often adjusted to match the current operating plans, it is expected that the oldest and usually higher heat rate units will be retired before the newer units. As these retirement dates are announced, they will be included in this plan. At this time there are no retirements included in this plan.

5.7. Dispatch of units

At PacifiCorp, the sale, production, transmission, distribution, and delivery of the electrical product all occur at the same instant of time. The dispatch of the generating units is handled by a dispatch group. This group, in real time, determines which unit will generate the next unit of electrical power. This is always the least cost MW determined by not only the least cost of generation at the plant, but considering the loss due to transmission, and many other factors. The dispatch group always has the most up-to-date values of unit heat rate, and all costs associated with each generating unit and source. This ensures that at any given instant of time that the next MW sold is the one that costs PacifiCorp, and therefore our customers, the least amount of money.

6. Heat Rate Index

Comparison of the planned heat rate (the heat rate which was originally purchased by PacifiCorp and intended by the designer) to the actual heat rate (that measured by PacifiCorp in real time), is called the Heat Rate Index. This is presented and shown in Figure 2 in the Appendix. From this, it can be seen how close our performance is to the designers' original intended performance. This will be tracked in the future to monitor how well our units are performing compared to how they should be performing. This is a new tool that should be very valuable to both the plants engineers and corporate management, both having the same goals of improved heat rate.

This should be a better indicator of how well the units are actually performing because a unit's ideal value of heat rate is very dependent on the generation level for which it is operating, and many other conditions that are not indicated by the heat rate alone.

7. Major Factors Effecting Currently Planned Net Heat Rate

This section of the heat rate plan identifies the system influences that will affect the Planned Net Heat Rate. Table 1 lists the units involved, the heat rate effects, and a time table for the planned changes.

7.1. Increase in electrical energy demand

Increases in electrical energy demand will probably be made up by gas-fueled generation. Gas fueled generation inherently has less losses, and therefore, an increased thermodynamic efficiency.

7.2. Displacement of Fossil-Fueled (Coal and Gas) Generation with Non-Fossil Generation (Wind, Hydro, Geothermal, and Solar)

Increases in available generation from non-fossil sources (Wind, Hydro, Geothermal, and Solar) will reduce the older fossil-fueled generation. These non-fossil sources are less predictable. This reduction will tend to be the gas-fueled generation due to higher fuel costs. However, the gas fuel costs presently seem to be falling. Reduced gas-fueled plant generation due to increased renewable generation will likely result in higher system fossil-fueled heat rate (reduced efficiency) due to reduced loads. The opposite of this effect is also possible. Reduced renewable generation would mean that fossil generation would increase and the resulting heat rate change would be for the better.

7.3. Environmental Plan Projects

Future environmental projects will generally include the addition of new SCR's. These will increase the unit's auxiliary load requiring more of the generators power to be used in-house for powering additional equipment, such as large motors, pumps, and fans. This will result in an increase in heat rate (reduced efficiency) due to the additional in-house electrical loads. There are several environmental projects scheduled over the next 10 years that will reduce efficiency (See Tables 2 and 3).

8. Major Unit Specific Initiatives

The hostile environment of coal fired electric power generation is very destructive to equipment. Coal units also have higher emissions. Therefore, it is wiser for PacifiCorp to focus on the "low hanging fruit" at coal fired plants where both the heat rate and emissions can be reduced the most. Of course, the gas fired power generation units have some potential for improving performance and heat rate, but in general the gas units potential for improvement is extremely small compared to the potential for improvement for a coal fired power generator. Prudence dictates that the coal units are dealt with more enthusiasm.

9. Annual Review and Update

This plan will be reviewed and updated annually by the PacifiCorp Energy management team by April 30, 2012.

10. Appendix

Figure 1 Notes
Includes Coal Fueled Units only.
"Planned Net Heat Rate" is based on the current operating plan.
"Actual Net Heat Rate" is based on Actual Total Consumed Fuel for each year divided by the Actual Net Generation for each year.

Figure 2 Notes
Includes Coal Fueled Units only for Index calculations.
Includes the following units: Carbon 1, Carbon 2, Dave Johnston 1, Dave Johnston 2, Dave Johnston 3, Dave Johnston 4, Huntington 1, Huntington 2, Hunter 1, Hunter 2, Hunter 3, Jim Bridger 1, Jim Bridger 2, Jim Bridger 3, Jim Bridger 4, Naughton 1, Naughton 2, Naughton 3, Wyodak 1.

Table 1 Notes
"System" is all of the units included on FERC Form 1 (a copy is attached as Table 4).
New Resources and Unit Retirements are not included in this table.

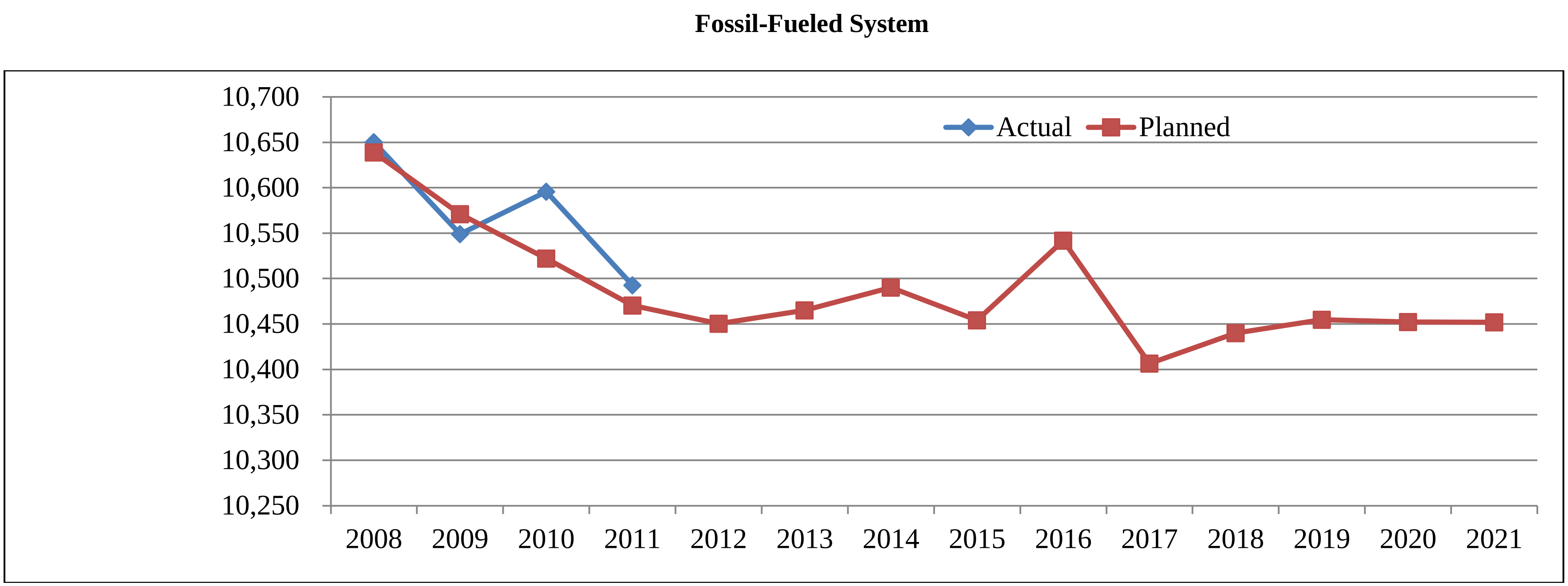
Table 2 Notes
"Plant/Unit" the specific unit with the project
"Budgeted/Planned …" A general description of the project.

"System" is the unit benefit divided by the impact of the specific unit on the system, weighted by the unit capacity compared to the system capacity, 7,455 MW per 2011 FERC form 1 line 6.
"Unit" is the benefit the specific unit will see alone before implementation compared to after implementation.
"Year" is the calendar year the benefit is realized.

Table 3 Notes

Includes other effects of the heat rate projects, minor changes to Auxiliary Load, and changes to Unit Rating in MW capacity.

Figure 1
Pacificorp Energy
10-year Plan Heat Rate Goals



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Planned Net Heat Rate, Btu/Kwh	10,639	10,571	10,522	10,471	10,450	10,465	10,490	10,454	10,542	10,406	10,440	10,455	10,452	10,452
Actual Net Heat Rate, Btu/Kwh	10,650	10,549	10,596	10,494										

Figure 2
Pacificorp Energy
4-Year Heat Rate Index History and Trend

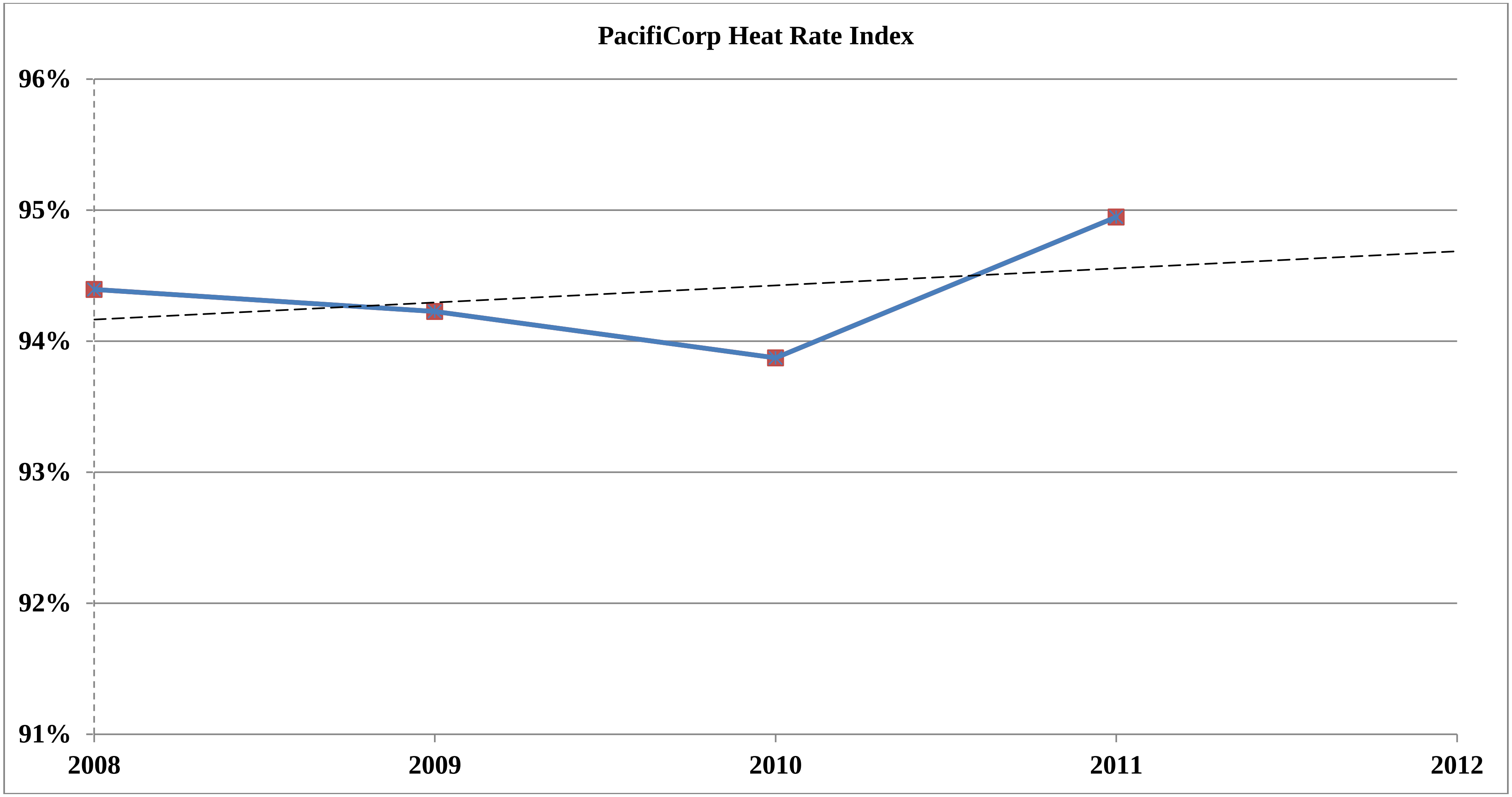


Table 1
Pacificorp Energy
10-year Plan Heat Rate Improvement Projects

Budgeted / Planned Heat Rate Changes, Net basis (Improvements are negative)											
Year		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Blundell	Btu/kWh										
Carbon 1	Btu/kWh										
Carbon 2	Btu/kWh										
Chehalis	Btu/kWh										
Currant Creek	Btu/kWh										
Dave Johnston 1	Btu/kWh										
Dave Johnston 2	Btu/kWh										
Dave Johnston 3	Btu/kWh					138					
Dave Johnston 4	Btu/kWh	138									
Gadsby 1	Btu/kWh										
Gadsby 2	Btu/kWh										
Gadsby 3	Btu/kWh										
Gadsby 4	Btu/kWh										
Gadsby 5	Btu/kWh										
Gadsby 6	Btu/kWh										
Hunter 1	Btu/kWh			32							
Hunter 2	Btu/kWh										36

Budgeted / Planned Heat Rate Changes, Net basis (Improvements are negative)											
Year		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Hunter 3	Btu/kWh	-378									36
Huntington 1	Btu/kWh										
Huntington 2	Btu/kWh										
Jim Bridger 1	Btu/kWh										
Jim Bridger 2	Btu/kWh		-182								
Jim Bridger 3	Btu/kWh				57						
Jim Bridger 4	Btu/kWh					57					
Lakeside	Btu/kWh										
Little Mountain	Btu/kWh										
Naughton 1	Btu/kWh	163									
Naughton 2	Btu/kWh										
Naughton 3	Btu/kWh			138							
Wyodak	Btu/kWh										
System HR benefit of Turbine Upgrades	Btu/kWh	-24	-26								
System HR effect of Environmental Projects	Btu/kWh	17		7	3	11					4
System HR effect of Other Heat Rate Improvement Projects	Btu/kWh			-2	-2	-1					-2
Total Adjustments from Heat Rate Improvement Projects – Current 10 Year Plan	Btu/kWh	-7	-26	5	1	10					0

Table 2
All Coal Fired Plants
10-year Plan Heat Rate Improvement Projects

Plant / Unit	Budgeted / Planned Heat Rate Changes, Net basis (Improvements are negative) Btu/kWh	System	Unit	Year	Project #	Estimated Cost
Dave Johnston 3	Clean Air Initiative - DFGD (90%), BH, LNB	4.0	138	2016	SDVJ/2007/898	$6,986,000
Dave Johnston 4	Clean Air Initiative - DFGD (90%), BH, LNB	6.1	138	2012	SDVJ/2007/901	$12,888,000
Hunter 1	Clean air initiative: Baghouse installation, wet stack	1.9	32	2014	10000939	$75,029,000
Hunter 2	Clean air initiative – SCR (Selective Catalytic Reduction)	1.3	36	2021	10009397	$57,301,000
Hunter 3	Clean air initiative – SCR (Selective Catalytic Reduction)	1.3	36	2021	10002885	$25,590,000
Hunter 3	Turbine Upgrade Dense Pack	-24.0	-378	2012	SHTR/2008/C/TU3	$10,968,000
Jim Bridger 2	Turbine Upgrade Dense Pack	-8.8	-182	2013	SJIM/2008/C/131	$40,000,000
Jim Bridger 3	SCR addition	2.8	57	2015	10003396	$177,749,000
Jim Bridger 4	SCR addition	2.8	57	2016	10009398	$202,203,000
Naughton 1	Flue Gas Desulfurization	3.5	163	2012	SNAU/2008/C/C04	$22,872,000
Naughton 3	SCR Baghouse (Pending)	6.1	138	2014	10007228	$253,213,000
	Total System Adjustments related to Capital Projects – Current 10 Year Plan	-3				

Table 3
Sample includes estimated changes for Carbon, Dave Johnston, Hunter, Huntington, Jim Bridger, Naughton, and Wyodak
Aux Load and Unit Rating Changes only
10-year Plan Heat Rate Improvement Projects

	Budgeted / Planned Auxiliary Load Changes		Unit	Year
Dave Johnston 1	Mercury Capture	KW	100	2014
Dave Johnston 2	Mercury Capture	KW	100	2014
Dave Johnston 3	Mercury Capture	KW	100	2014
Dave Johnston 4	Mercury Capture	KW	100	2014
Jim Bridger 1	Mercury Capture	KW	100	2014
Jim Bridger 2	Mercury Capture	KW	100	2014
Jim Bridger 3	Mercury Capture	KW	100	2014
Jim Bridger 4	Mercury Capture	KW	100	2014
Naughton 1	Mercury Capture	KW	100	2014
Naughton 2	Mercury Capture	KW	100	2014
Naughton 3	Mercury Capture	KW	100	2014
Wyodak	Mercury Capture	KW	100	2014

	Budgeted / Planned Net Dependable Rating Changes, (Net Basis)		Unit	Year
Dave Johnston 3	Unit Re-rated after Environmental Projects	MW	10	2014
Dave Johnston 4	Clean Air Initiative - DFGD (90%), BH, LNB	MW	-4.4	2012
Hunter 1	Clean air initiative: wet stack & baghouse	MW	-1.5	2014
Hunter 2	Clean air initiative – SCR	MW	-2.4	2021
Hunter 3	Turbine Upgrade DensePack	MW	19	2012

Jim Bridger 2	Turbine Upgrade Dense Pack	MW	18	2013
Jim Bridger 3	SCR addition	MW	-3.2	2015
Jim Bridger 4	SCR addition	MW	-3.3	2016
Naughton 1	Scrubber Addition	MW	-2.6	2012
Naughton 3	Increased CAI load	MW	-4.5	2014
	Total Capacity Changes – Current 10 Year Plan	MW	25.1	

Table 4
FERC Form 1
Past 10 years and Summary Sheet

11. Required Signatures

Corporate Heat Rate Engineer	Bernard Hall		
Signature:		Date:	May 1, 2012

Manager, Engineering/Environmental	Greg Hunter		
Signature:		Date:	May 1, 2012

Managing Director, Generation Support	Rod Roberts		
Signature:		Date:	May 1, 2012