

## Section 5.4.7 "BREC Facilities Study (July 31, 2003)"



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oop>

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To: "John Gardner" <jrgardner@tva.gov>, <howardjl@omu.org>, "Eric Lavery" <elavery@midwestiso.org>, <darrin.adams@lgeenergy.com>, Scott Yaeger/STL/Peabody@PeabodyEnergy, <demarler@tva.gov>, <hunzingerre@omu.org>  
cc: "David Crockett" <dcrockett@bigrivers.com>  
Subject: Thoroughbred Studies

Thoroughbred Study Group,

Burns & McDonnell recently completed a Facilities Study (cost estimate and project schedule) for facilities necessary to connect the proposed Thoroughbred Generating Station. While detailed, the estimate did not include all expenses anticipated by Big Rivers (design review, inspection, right-of-way acquisition, etc.). Because of this, the Burns and McDonnell estimate has been revised and is attached. Included in this estimate are "place holders" (\$0.00) for terminal expenses at OMU's Elmer Smith Station, LG&E's Hardin Station, and TVA's Paradise Station.

The system improvements included in the Facilities Study vary slightly from those described in the Generation Interconnection Study. The preferred interconnection plan described in that study included a 345 kV loop (a nine mile new terrain route from the existing Wilson to Coleman EHV line to Elmer Smith). However, studies completed as part of the Generation Interconnection Study also showed a 345 kV switching station to be an acceptable alternative to the 345 kV loop line. Cost estimates prepared by Burns & McDonnell showed a 345 kV switching station to be more cost effective than the loop. Consequently, the switching station was chosen for inclusion in the final Facilities Study.

While very similar electrically, the switching station would create a new Big Rivers to LG&E interconnection rather than the Big Rivers to OMU interconnection created by the loop. Since Big Rivers intends to pursue the switching in lieu of the loop, LG&E, MISO, and OMU are invited to comment on the altered interconnection configuration that includes the switching station.

As we transition from the Facilities Study into developing a draft Interconnection and Operating Agreement (IOA) between Big Rivers and Thoroughbred Generating Company, many issues and details need to be addressed. They include interconnection costs, agreements, and contracts (especially with the proposed facilities made-up primarily of interconnections). Big Rivers would propose that the switching station and its corresponding interconnection related facilities, as well as the Wilson to Paradise interconnection with TVA and corresponding facilities, be covered under an IOA with Thoroughbred. On the surface, it seems that the agreements and contracts relating directly to the proposed new interconnections would be accomplished through new or amended interconnection agreements between Big Rivers and LG&E and between Big Rivers and TVA. Big Rivers requests input from the group in regard to the contractual treatment of these interconnection facilities.

Additional third-party system improvements (breaker replacements and other facilities remote from the Big Rivers system) will require agreements and contracts executed by Peabody and the third party utility only (or a three party agreement that includes MISO). Since Big Rivers will not be a party to these agreements, we defer to Thoroughbred and the third party utility in regard to the completion and execution of any necessary agreement.

I would like to schedule a final conference call to address any outstanding issues in regard to the Thoroughbred Interconnection Study (including a discussion of the 345 kV switching station). I propose a morning call during either the week of August 11-15 or the week of August 18-22. Please advise as to your availability. As always, if you have any questions, feel free to contact me at (270) 827-2561.

Thank You,

Chris Bradley  
Senior Planning Engineer  
Big Rivers Electric Corporation



270-827-2561 x2226 Thoroughbred Facilities Study - Costs Thoroughbred Facilities Study - Schedule

# Cost Estimate Summary



**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

## Cost Estimate Summary

Facility Description	Cost
Thoroughbred 345kV Switchyard	----
EHV Switching Station	5,854,068
Wilson 345kV Addition	3,940,752
Wilson 161kV Addition	1,363,935
Single-Circuit 345-kV Line (H-frame)	6,272,065
Double-Circuit 345/161-kV Line	12,678,033
Single-Circuit 161-kV Line	5,124,508
Right-of-Way (BREC Est.)	2,150,000
<b>Sub Total</b>	<b>\$ 37,383,361</b>
Engineering oversight & Misc.	100,000
TVA Paradise Terminal	0
<b>Total</b>	<b>\$ 37,483,361</b>

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**345kV Thoroughbred Switchyard - Not a Big Rivers network upgrade.**

		Summary			
		Switches	Foundations (cyd)	Site	L
Bays		0	0		0
Breakers		0	0		0
Generators		0	0		0
Transmission Lines		0	0.00		
Main Bus		0	0	Bus (ft)	0

	Cost			Total
	Materials	Labor		
Site	\$	-	-	\$
Land	\$	-	-	\$
Breakers	\$	-	-	\$
Switches	\$	-	-	\$
Steel	\$	-	-	\$
Instrument Transformers	\$	-	-	\$
Surge Arresters	\$	-	-	\$
Control Building	\$	-	-	\$
Relay Panels	\$	-	-	\$
Connectors, Bus, etc.	\$	-	-	\$
Rock	\$	-	-	\$
Fence	\$	-	-	\$
Grounding	\$	-	-	\$
Cable/Raceway	\$	-	-	\$
Foundations	\$	-	-	\$
Communications (Backup)	\$	-	-	\$
Engineering	\$	-	-	\$
Surveying	\$	-	-	\$
Soil Borings	\$	-	-	\$
Testing	\$	-	-	\$
Cost	\$	-	-	\$
Const. Overhead	\$	-	-	\$
Margin	\$	-	-	\$
Sales Tax	\$	-	-	\$
Amount	\$	-	-	\$

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**EHV Switching Station**

Summary						
	2	4	0	4	2	Summary
Bays	2	4	0	4	2	12
Circuit Breakers	4	0	4	2		14
Generators	0	4				0
Transmission Lines	4					12
Main Bus	2					11
						Switches
						CCVT's
						CT's
						S.A.'s
						Relay Panels
						Foundations (cyd)
						Grounding (ft)
						Fence (ft)
						Steel (ton)
						Cable/Rcwy (ft)
						Site
						L
						W
						Bus (ft)
						800

	Cost		Total
	Materials	Labor	
Site	\$ 25,000	\$ 150,000	\$ 175,000
Land	\$ 50,000	-	\$ 50,000
Breakers	\$ 820,000	\$ 70,000	\$ 890,000
Switches	\$ 168,000	\$ 72,000	\$ 240,000
Steel	\$ 323,620	\$ 110,325	\$ 433,945
Instrument Transformers	\$ 98,000	\$ 12,600	\$ 110,600
Surge Arresters	\$ 108,000	\$ 10,800	\$ 118,800
Control Building	\$ 175,000	\$ 15,000	\$ 190,000
Relay Panels	\$ 305,400	\$ 16,500	\$ 321,900
Connectors, Bus, etc.	\$ 48,000	\$ 72,000	\$ 120,000
Rock	\$ 130,000	\$ 48,750	\$ 178,750
Fence	\$ 27,000	\$ 9,000	\$ 36,000
Grounding	\$ 29,575	\$ 76,050	\$ 105,625
Cable/Raceway	\$ 55,300	\$ 63,200	\$ 118,500
Foundations	\$ 113,000	\$ 474,600	\$ 587,600
Microwave Tower	\$ 65,000	\$ 15,000	\$ 80,000
Existing Line Modifications	\$ 125,000	\$ 125,000	\$ 250,000
Engineering	\$ -	\$ 450,000	\$ 450,000
Surveying	\$ -	\$ 25,000	\$ 25,000
Soil Borings	\$ -	\$ 20,000	\$ 20,000
Testing	\$ -	\$ 125,000	\$ 125,000
Cost	\$ 2,665,895	\$ 1,960,825	\$ 4,626,720
Const. Overhead	20%	\$ 392,165	\$ 392,165
Margin	15%	\$ 294,124	\$ 294,124
Sales Tax	6%	\$ -	\$ -
Amount		\$ 2,647,114	\$ 5,854,068

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**345kV Wilson Switchyard**

		Summary			
Breakers	2	Switches	10	Foundations (cyd)	644
Generators	4	CCVT's	6	Grounding (ft)	12,325
Transmission Lines	0	CT's	0	Fence (ft)	1,650
Main Bus	2	S.A.'s	6	Steel (ton)	104.50
	0	Relay Panels	6	Cable/Rcwy (ft)	20,400
				Site	L W
					575 250
				Bus (ft)	1400

	Cost			Total
	Materials	Labor		
Site	\$ -	\$ 75,000	\$ -	\$ 75,000
Land	\$ 20,000	\$ -	\$ -	\$ 20,000
Breakers	\$ 820,000	\$ 70,000	\$ -	\$ 890,000
Switches	\$ 140,000	\$ 60,000	\$ -	\$ 200,000
Steel	\$ 238,260	\$ 78,375	\$ -	\$ 316,635
Instrument Transformers	\$ 42,000	\$ 5,400	\$ -	\$ 47,400
Surge Arresters	\$ 54,000	\$ 5,400	\$ -	\$ 59,400
Control Building	\$ -	\$ 15,000	\$ -	\$ 15,000
Relay Panels	\$ 162,200	\$ 9,000	\$ -	\$ 171,200
Connectors, Bus, etc.	\$ 48,000	\$ 126,000	\$ -	\$ 174,000
Rock	\$ 93,438	\$ 35,039	\$ -	\$ 128,477
Fence	\$ 24,750	\$ 8,250	\$ -	\$ 33,000
Grounding	\$ 21,569	\$ 55,463	\$ -	\$ 77,031
Cable/Raceway	\$ 35,700	\$ 40,800	\$ -	\$ 76,500
Foundations	\$ 80,500	\$ 338,100	\$ -	\$ 418,600
Communications	\$ 10,000	\$ 5,000	\$ -	\$ 15,000
Modify Wilson	\$ 50,000	\$ 10,000	\$ -	\$ 60,000
Modify Coleman	\$ 50,000	\$ 10,000	\$ -	\$ 60,000
Modify OMU	\$ -	\$ -	\$ -	\$ -
Modify KU	\$ -	\$ -	\$ -	\$ -
Engineering	\$ -	\$ 225,000	\$ -	\$ 225,000
Surveying	\$ -	\$ 5,000	\$ -	\$ 5,000
Soil Borings	\$ -	\$ 5,000	\$ -	\$ 5,000
Testing	\$ -	\$ 50,000	\$ -	\$ 50,000
	Cost	\$ 1,890,416	\$ 1,231,827	\$ 3,122,243
Const. Overhead	20%	\$ -	\$ 246,365	\$ 246,365
Margin	15%	\$ 297,103	\$ 184,774	\$ 481,877
Sales Tax	6%	\$ 90,268	\$ -	\$ 90,268
Amount		\$ 2,277,786	\$ 1,662,966	\$ 3,940,752

Original Burns & Mc Est. was 50,000 mat + 10,000 labor  
 Original Burns & Mc Est. was 50,000 mat + 10,000 labor

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&MCD Project # 33729**

**161kV Wilson Switchyard**

		<b>Summary</b>				Site	
		Switches	Foundations (cyd)	Grounding (ft)	Fence (ft)	L	W
Bays	1	5	168	0	0		0
Breakers	2	3	0	0	0		0
Generators	0	0	0	0	0		0
Transmission Lines	1	3	25.90				
Main Bus	0	3	7,800				
		Relay Panels					350
							Bus (ft)

		<b>Cost</b>			Total
		Materials	Labor		
Site	\$	-	40,000	\$	40,000
Land	\$	-	-	\$	-
Breakers	\$	120,000	10,000	\$	130,000
Switches	\$	37,500	22,500	\$	60,000
Steel	\$	56,980	19,425	\$	76,405
Instrument Transformers	\$	18,000	2,250	\$	20,250
Surge Arresters	\$	3,000	2,250	\$	5,250
Control Building	\$	-	15,000	\$	15,000
Relay Panels	\$	96,100	4,500	\$	100,600
Connectors, Bus, etc.	\$	18,000	31,500	\$	49,500
Rock	\$	-	10,000	\$	10,000
Fence	\$	-	-	\$	-
Grounding	\$	3,000	9,000	\$	12,000
Cable/Raceway	\$	13,650	15,600	\$	29,250
Foundations	\$	21,000	88,200	\$	109,200
Communications	\$	120,000	30,000	\$	150,000
Engineering	\$	-	150,000	\$	150,000
Surveying	\$	-	5,000	\$	5,000
Soil Borings	\$	-	5,000	\$	5,000
Testing	\$	-	25,000	\$	25,000
Cost	\$	507,230	485,225	\$	992,455
Const. Overhead	\$	-	198,491	\$	198,491
Margin	\$	79,231	72,784	\$	152,014
Sales Tax	\$	20,975	-	\$	20,975
Amount	\$	607,436	756,500	\$	1,363,935

changed from 10,000 mat. + 5,000 labor by Big Rivers

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Steel Cost (per Unit)**

	Weight (tons)	Cost
<b>345KV</b>		
Dead End	24	\$ 52,800
Switch Stand	2.5	\$ 5,500
Bus Support, High	0.5	\$ 1,100
Bus Support, Low	0.4	\$ 880
CCVT Stand	0.4	\$ 880
CT Stand	0.4	\$ 880
Surge Arrester Stand	0.4	\$ 880

	Weight (tons)	Cost
<b>161KV</b>		
Dead End	13	\$ 28,600
Switch Stand	1	\$ 2,200
Bus Support, High	0.4	\$ 880
Bus Support, Low	0.3	\$ 660
CCVT Stand	0.3	\$ 660
CT Stand	0.3	\$ 660
Surge Arrester Stand	0.3	\$ 660

Steel Cost \$ 1.10 per lb  
 Steel Installation \$ 750 per ton



**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Equipment Cost**

	Materials	Installation	
<b>345kV</b>			
Switch, 345kV	\$ 14,000	\$ 6,000	
Breaker, 345kV	\$ 205,000	\$ 17,500	
CCVT, Relay Accuracy	\$ 7,000	\$ 900	
CCVT, Metering Accuracy	\$ 10,000	\$ 900	For revenue metering
CT, Extended Range, Metering	\$ 16,000	\$ 900	
Surge Arrester	\$ 9,000	\$ 900	
Tubular Bus / foot	\$ 60	\$ 90	Includes insulators, jumpers and connectors
<b>161kV</b>			
Switch	\$ 7,500	\$ 4,500	
Breaker	\$ 60,000	\$ 5,000	
CCVT	\$ 6,000	\$ 750	
Surge Arrester	\$ 1,000	\$ 750	
Tubular Bus / foot	\$ 45	\$ 90	Includes insulators, jumpers and connectors

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Cable/Raceway Summary**

	400	feet average per circuit
<b>Thoroughbred</b>		
Breaker	16,000 feet	
CCVT	8,800 feet	
CT	3,600 feet	
SS	1,600 feet	
Lighting	6,000 feet	
Fiber	400 feet	
<b>Total</b>	<b>36,400 feet</b>	

	400	feet average per circuit
<b>EHV Sw. Sta.</b>		
Breaker	12,800 feet	
CCVT	11,200 feet	
SS	1,600 feet	
Lighting	6,000 feet	
<b>Total</b>	<b>31,600 feet</b>	

	400	feet average per circuit
<b>Wilson 345</b>		
Breaker	12,800 feet	
CCVT	4,800 feet	
Lighting	2,400 feet	
Fiber	400 feet	
<b>Total</b>	<b>20,400 feet</b>	

	300	feet average per circuit
<b>Wilson 161</b>		
Breaker	4,800 feet	
CCVT	1,800 feet	
Lighting	900 feet	
Fiber	300 feet	
<b>Total</b>	<b>7,800 feet</b>	

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Miscellaneous Items**

	Concrete (cyd)	Surface Rock (ton)	Grounding (ft)	Fence (ft)	Cable w/Raceway (ft)
Materials cost	\$125	\$20	\$1.75	\$15	\$1.75
Labor cost	\$525	\$7.50	\$4.50	\$5	\$2.00

Foundation Quantities				
Item	Length (ft)	Width or Diam. (ft)	Height/Depth (ft)	Est Concrete Volume (yds)
<b>345KV</b>				
345KV A-Frame Dead End	5	5	40	29
345KV CT Stand	3	3	15	4
345KV Surge Arrester Stand	3	3	15	4
345KV 1 Phase Bus Support	3	3	15	4
345KV Low Switch Stand	3	3	15	4
345KV CCVT Support	3	3	15	4
345KV Circuit Breaker	15	8	2.5	11
Control Building	30	20	2.5	56
<b>161KV</b>				
161KV A-Frame Dead End	5	5	20	15
161KV Surge Arrester Stand	3	3	10	3
161KV 1 Phase Low Bus Support	3	3	10	3
161KV Low Switch Stand	3	3	10	3
161KV CCVT Support	3	3	10	3
161KV Circuit Breaker	10	6	2.5	6

	Concrete totals
Thoroughbred	863
EHV Sw. Sta.	904
Wilson 345	644
Wilson 161	168

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Protection and Controls**

Thoroughbred Relay Panel Estimate										
	COMM RLY	RTU	21P	21B	BF	87B	51	MUX	Misc Devices	Total (2500+relays+300/device)
Panel	\$4,000	\$45,000	\$10,000	\$10,000	\$3,500	\$5,000	\$4,000	\$10,000	\$300	22,300
Comm	2	0	0	0	0	0	0	1	6	49,300
DCS	0	1	0	0	0	0	0	0	8	32,900
Line	0	0	1	1	0	0	2	0	8	17,900
Bus	0	0	0	0	0	1	2	0	8	6,100
Gen.	0	0	0	0	0	0	0	0	12	16,600
Breaker	0	0	0	0	3	0	0	0	12	16,600

Relay Panel Installation \$ 1,500

Thoroughbred		Inter. SWYD	
1	COM/DCS	71,600	1
2	Line	65,800	4
1	Gen	6,100	0
5	Bkr	83,000	4
2	Bus	35,800	2
11		<b>\$262,300</b>	<b>11</b>
			<b>\$ 305,400</b>

Wilson 345		Wilson 161	
Modify	COM/DCS	15,000	1
2	Line	65,800	0
0	Gen	0	2
4	Bkr	66,400	3
6	Bus	15,000	3
		<b>\$162,200</b>	<b>3</b>
			<b>\$ 96,100</b>

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&M&D Project # 33729**

**Estimated Transmission Line Costs**

Transmission Line Route Line Voltage(s) Basic Structure Configuration Estimated Line Route Length, Mile(s)	Installed Structure Cost (\$)	Single Circuit 345-kV Steel H-Frame 11.00		Single Circuit 345KV Single Pole Tubular Steel 11.00		Double Circuit 345/161KV Single Pole Tubular Steel 11.00		Single Circuit (Route W2) 161KV Single Pole Tubular Steel 13.00	
		Structure Type & Qty		Structure Type & Qty		Structure Type & Qty		Structure Type & Qty	
		Qty	Costs (\$)	Qty	Costs (\$)	Qty	Costs (\$)	Qty	Costs (\$)
345KV SC Steel H-Frame, Tangent	27,228	69	1,878,698	-	-	-	-	-	-
345KV SC Steel H-Frame, 5-10 Deg.	32,402	1	32,402	-	-	-	-	-	-
345KV SC Steel H-Frame, 10-20 Deg.	41,817	1	41,817	-	-	-	-	-	-
345KV SC Steel Vert. Deadend, 30-45 Deg.	112,778	3	338,333	3	338,333	3	338,333	3	338,333
345KV SC Steel Vert. Deadend, 45-60 Deg.	117,505	3	352,514	3	352,514	3	352,514	3	352,514
345KV SC Steel Vert. Deadend, 60-75 Deg.	133,413	-	-	-	-	-	-	-	-
345KV SC Steel Vert. Deadend, 75-90 Deg.	143,484	1	143,484	1	143,484	1	143,484	1	143,484
345KV SC Steel Vert. Deadend, Terminal	114,305	2	228,611	2	228,611	2	228,611	2	228,611
345KV SC Tubular Steel, Tangent	42,728	-	-	69	2,948,198	-	-	-	-
345KV SC Tubular Steel, 5-10 Deg.	67,505	-	-	1	67,505	-	-	-	-
345KV SC Tubular Steel, 10-20 Deg.	94,208	-	-	1	94,208	-	-	-	-
345/161KV DC Tubular Steel, Tangent	75,082	2	150,164	2	150,164	69	5,180,651	69	5,180,651
345/161KV DC Tubular Steel, 5-10 Deg.	111,608	-	-	-	-	1	111,608	1	111,608
345/161KV DC Tubular Steel, 10-20 Deg.	100,697	-	-	-	-	1	100,697	1	100,697
161KV SC Tubular Steel, Tangent	17,456	-	-	-	-	1	17,456	85	1,483,786
161KV SC Tubular Steel, 5-10 Deg.	38,459	-	-	-	-	1	38,459	1	38,459
161KV SC Tubular Steel, 10-20 Deg.	54,726	-	-	-	-	4	218,902	4	218,902
161KV SC Tubular Steel, 20-30 Deg.	72,121	-	-	-	-	1	72,121	1	72,121
161KV SC Steel Vert. Deadend, 30-45 Deg.	96,225	-	-	-	-	3	288,675	3	288,675
161KV SC Steel Vert. Deadend, 45-60 Deg.	99,580	-	-	-	-	4	398,319	4	398,319
161KV SC Steel Vert. Deadend, 60-75 Deg.	106,797	-	-	-	-	-	-	-	-
161KV SC Steel Vert. Deadend, 75-90 Deg.	115,763	-	-	-	-	-	-	-	-
161KV SC Steel Vert. Deadend, Terminal	93,059	-	-	-	-	-	-	-	-
161KV SC Steel H-Frame, In-Line Deadend	136,940	-	-	-	-	1	136,940	1	136,940
161KV SC Steel H-Frame Angle Deadend	146,546	-	-	-	-	1	146,546	1	146,546
1/2" OHGW Installation (\$ / Mile)	5,544	1	64,033	1	64,033	1	64,033	1	64,033
OPGW Installation (\$ / Mile)	17,107	1	197,588	1	197,588	1	197,588	1	197,588
795 Kcmil Bundled ACSR Drake (\$ / Ckt Mile)	71,616	1	1,302,618	1	1,302,618	1	827,163	1	827,163
1590 Kcmil Bundled ACSR Lapwing (\$ / Ckt Mile)	112,781	1	1,302,618	1	1,302,618	1	1,302,618	1	1,302,618
<b>Route Material Costs</b>	<b># Str.</b>	<b>82</b>	<b>4,730,262</b>	<b>82</b>	<b>5,887,256</b>	<b>90</b>	<b>9,835,236</b>	<b>97</b>	<b>3,644,306</b>
<b>Survey &amp; Staking Fee</b>									
Aerial Survey & Profile Data (Cost / Mile)		1,750	19,250	1,750	19,250	1,750	19,250	1,750	22,750
P.I. & Structure Staking (Cost / Mile)		1,500	16,500	1,500	16,500	1,500	16,500	1,500	19,500
<b>Right-of-Way Clearing and Access Improvements</b>									
Clearing, Disposal, Access (Cost / Acre)		3,000	560,000	3,000	560,000	3,000	840,000	3,000	709,091
<b>Engineering Fee</b>									
% Material & Labor Costs		10	473,026	10	588,726	10	983,524	10	364,431
<b>Construction Inspection Fee</b>									
% Material & Labor Costs		10	473,026	10	588,726	10	983,524	10	364,431
<b>Total Installed Cost Per Route</b>			<b>6,272,065</b>		<b>7,660,457</b>		<b>12,678,033</b>		<b>5,124,508</b>

**Peabody Energy/Big Rivers Electric Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Estimated Transmission Line Costs**

Structure Material Costs											
Structure Type	Estimated Ground Line Moment (Ft. Kips)	Estimated Weights			Total Structure Weight	Steel Cost / Lb.	Structure Cost	Pole Top Assembly Cost	Damper & Spacer Cost	Sales Tax 6%	Material Cost Per Structure
		Shaft	Baseplate	Arms							
345KV SC Steel H-Frame, Tangent	---	6,520	---	2,500	9,020	1.00	\$ 9,020	\$ 2,385	\$ 670	\$ 725	\$ 12,800
345KV SC Steel H-Frame, 5-10 Deg.	---	8,140	---	2,750	10,890	1.10	11,979	2,385	670	902	15,936
345KV SC Steel H-Frame, 10-20 Deg.	---	10,500	---	3,000	13,500	1.10	14,850	3,360	670	1,133	20,013
345KV SC Steel Vert. Deadend, 30-45 Deg.	12,443	25,000	3,400	---	31,200	1.10	34,320	13,140	670	2,888	51,018
345KV SC Steel Vert. Deadend, 45-60 Deg.	12,915	26,500	3,650	---	33,160	1.10	36,476	13,140	670	3,017	53,303
345KV SC Steel Vert. Deadend, 60-75 Deg.	15,582	32,500	4,675	---	41,025	1.10	45,128	13,140	670	3,536	62,474
345KV SC Steel Vert. Deadend, 75-90 Deg.	17,981	35,250	5,100	---	44,550	1.10	49,005	10,890	670	3,634	64,199
345KV SC Steel Vert. Deadend, Terminal	12,443	25,000	3,400	---	31,200	1.10	34,320	13,140	670	2,888	51,018
345KV SC Tubular Steel, Tangent	1,906	9,000	1,450	2,720	14,370	1.00	14,370	2,285	670	1,040	18,365
345KV SC Tubular Steel, 5-10 Deg.	4,179	15,250	2,625	2,800	22,775	1.10	25,053	2,285	670	1,680	29,688
345KV SC Tubular Steel, 10-20 Deg.	7,156	22,250	3,750	2,900	31,900	1.10	35,090	3,260	670	2,341	41,361
345/161KV DC Tubular Steel, Tangent	3,828	19,000	2,525	3,470	27,020	1.00	27,020	3,725	1,120	1,912	33,777
345/161KV DC Tubular Steel, 5-10 Deg.	8,289	31,350	4,150	3,600	42,400	1.10	46,640	3,725	1,120	3,089	54,574
345/161KV DC Tubular Steel, 10-20 Deg.	14,086	24,750	4,210	3,750	36,175	1.10	39,793	5,090	1,120	2,760	48,763
161KV SC Tubular Steel, Tangent	1,113	6,610	---	745	7,355	1.00	7,355	1,710	640	582	10,287
161KV SC Tubular Steel, 5-10 Deg.	2,531	9,000	1,825	785	13,085	1.10	14,394	1,710	640	1,005	17,749
161KV SC Tubular Steel, 10-20 Deg.	4,358	14,750	2,675	820	20,395	1.10	22,435	2,335	640	1,525	26,935
161KV SC Tubular Steel, 20-30 Deg.	5,885	18,500	3,300	---	24,450	1.10	26,895	2,335	640	1,792	31,662
161KV SC Steel Vert. Deadend, 30-45 Deg.	10,091	22,500	3,825	---	29,475	1.10	32,423	9,760	640	2,569	45,392
161KV SC Steel Vert. Deadend, 45-60 Deg.	10,526	23,500	4,000	---	30,790	1.10	33,869	9,760	640	2,656	46,925
161KV SC Steel Vert. Deadend, 60-75 Deg.	12,679	25,750	4,375	---	33,730	1.10	37,103	9,760	640	2,850	50,353
161KV SC Steel Vert. Deadend, 75-90 Deg.	14,621	28,250	4,810	---	37,015	1.10	40,717	8,110	640	2,968	52,435
161KV SC Steel Vert. Deadend, Terminal	10,091	22,500	3,825	---	29,475	1.00	29,475	9,760	640	2,393	42,268
161KV SC Steel H-Frame, In-Line Deadend	---	28,750	4,890	4,500	43,890	1.10	48,279	9,650	640	3,514	62,083
161KV SC Steel H-Frame Angle Deadend	---	30,375	5,165	4,750	46,365	1.10	51,002	9,650	640	3,678	64,970

**Peabody Energy/Big Rivers Electrical Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Estimated Transmission Line Costs**

Structure & Foundation Labor & Material Costs													
Structure Type	Material Multiplier (%)	Labor Cost For Structure	Structure Foundation Costs						Fdn. Cost Per Str.	Labor & Fdn. Costs Per Str.	Total Installed Structure Cost		
			Foundation Size			Backfill							
			Dia. (ft)	Length (ft)	Cuyd	# Fdns.	Type	Cost / Cuyd					
345kV SC Steel H-Frame, Tangent	65	\$ 8,320	5	14	10.18	2	Crush Rock	\$ 6,108	\$ 14,428	\$ 27,228			
345kV SC Steel H-Frame, 5-10 Deg.	65	10,368	5	14	10.18	2	Crush Rock	6,108	16,466	32,402			
345kV SC Steel H-Frame, 10-20 Deg.	65	13,008	6	14	14.66	2	Crush Rock	8,796	21,804	41,817			
345kV SC Steel Vert. Deadend, 30-45 Deg.	40	20,407	9	27	63.62	1	Concrete	41,353	61,760	112,778			
345kV SC Steel Vert. Deadend, 45-60 Deg.	40	21,321	9	28	65.97	1	Concrete	42,881	64,202	117,505			
345kV SC Steel Vert. Deadend, 60-75 Deg.	40	24,990	9	30	70.69	1	Concrete	45,949	70,939	133,413			
345kV SC Steel Vert. Deadend, 75-90 Deg.	40	25,680	9	35	82.47	1	Concrete	53,606	79,286	143,484			
345kV SC Steel Vert. Deadend, Terminal	40	20,407	9	28	65.97	1	Concrete	42,881	63,288	114,305			
345kV SC Tubular Steel, Tangent	40	7,346	6	25	26.18	1	Concrete	17,017	24,363	42,728			
345kV SC Tubular Steel, 5-10 Deg.	40	11,875	7	28	39.91	1	Concrete	25,942	37,817	67,505			
345kV SC Tubular Steel, 10-20 Deg.	40	16,544	8	30	55.85	1	Concrete	36,303	52,847	94,208			
345/161kV DC Tubular Steel, Tangent	40	13,511	7	30	42.76	1	Concrete	27,794	41,305	75,082			
345/161kV DC Tubular Steel, 5-10 Deg.	40	21,830	7	38	54.16	1	Concrete	35,204	57,034	111,608			
345/161kV DC Tubular Steel, 10-20 Deg.	40	19,505	7	35	49.89	1	Concrete	32,429	51,934	100,697			
161kV SC Tubular Steel, Tangent	40	4,115	5	14	10.18	1	Crush Rock	3,054	7,169	17,456			
161kV SC Tubular Steel, 5-10 Deg.	40	7,099	6	20	20.94	1	Concrete	13,611	20,710	38,459			
161kV SC Tubular Steel, 10-20 Deg.	40	10,774	6	25	26.18	1	Concrete	17,017	27,791	54,726			
161kV SC Tubular Steel, 20-30 Deg.	40	12,665	7	30	42.76	1	Concrete	27,794	40,459	72,121			
161kV SC Steel Vert. Deadend, 30-45 Deg.	40	18,157	8	27	50.27	1	Concrete	32,676	50,833	96,225			
161kV SC Steel Vert. Deadend, 45-60 Deg.	40	18,770	8	28	52.13	1	Concrete	33,885	52,655	99,580			
161kV SC Steel Vert. Deadend, 60-75 Deg.	40	20,141	8	30	55.85	1	Concrete	36,303	56,444	106,797			
161kV SC Steel Vert. Deadend, 75-90 Deg.	40	20,974	8	35	65.16	1	Concrete	42,354	63,328	115,763			
161kV SC Steel Vert. Deadend, Terminal	40	16,907	8	28	52.13	1	Concrete	33,885	50,792	93,059			
161kV SC Steel H-Frame, In-Line Deadend	40	24,833	7	27	38.48	2	Concrete	50,024	74,857	136,940			
161kV SC Steel H-Frame Angle Deadend	40	25,988	7	30	42.76	2	Concrete	55,588	81,576	146,546			

**Peabody Energy/Big Rivers Electrical Corporation**  
**Thoroughbred Generation Station Interconnection Facilities**  
**B&McD Project # 33729**

**Estimated Transmission Line Costs**

	Material Cost (ea)
<b>Insulator Hardware</b>	
345kV OHGW Insulated Susp. Assy.	95
345kV OHGW Insulated Dbl. Susp. Assy.	205
345kV OHGW Grounded Deadend Assy.	95
345kV OHGW Insulated Deadend Assy.	125
161kV OHGW Suspension Assy.	75
161kV OHGW Angle Dbl. Susp. Assy.	185
161kV OHGW Deadend Assy.	95
OPGW Suspension Assy.	170
OPGW Angle Suspension Assy.	405
OPGW Deadend Assy.	195
345kV I-String Suspension Assy.	640
345kV V-String Suspension Assy.	1,580
345kV Angle Suspension Assy.	850
345kV Deadend Assy.	1,750
345kV Horizontal Post Jumper Assy.	750
161kV Suspension Assy.	480
161kV Angle Suspension Assy.	610
161kV Deadend Assy.	1,270
161kV Horizontal Post Jumper Assy.	550
Structure Grounding, (1) Grd. Rod Assy.	100
Installed Crushed Rock, (\$)/Cuyd	300
Installed Concrete, (\$)/Cuyd	650

**Pole Top Assembly Cost**

Structure Type	OHGW \$	OPGW \$	161-kV Trans. \$	345kV Trans. \$	Grounding \$	Material Cost Per Structure \$
345kV SC Steel H-Frame, Tangent	95	170	-	1,920	200	2,385
345kV SC Steel H-Frame, 5-10 Deg.	95	170	-	1,920	200	2,385
345kV SC Steel H-Frame, 10-20 Deg.	205	405	-	2,550	200	3,360
345kV SC Steel Vert. Deadend, 30-45 Deg.	95	195	-	12,750	100	13,140
345kV SC Steel Vert. Deadend, 45-60 Deg.	95	195	-	12,750	100	13,140
345kV SC Steel Vert. Deadend, 60-75 Deg.	95	195	-	12,750	100	13,140
345kV SC Steel Vert. Deadend, 75-90 Deg.	95	195	-	10,500	100	10,890
345kV SC Steel Vert. Deadend, Terminal	95	195	-	12,750	100	13,140
345kV SC Tubular Steel, Tangent	95	170	-	1,920	100	2,285
345kV SC Tubular Steel, 5-10 Deg.	95	170	-	1,920	100	2,285
345kV SC Tubular Steel, 10-20 Deg.	205	405	-	2,550	100	3,260
345/161kV DC Tubular Steel, Tangent	95	170	1,440	1,920	100	3,725
345/161kV DC Tubular Steel, 5-10 Deg.	95	170	1,440	1,920	100	3,725
345/161kV DC Tubular Steel, 10-20 Deg.	205	405	1,830	2,550	100	5,090
161kV SC Tubular Steel, Tangent	-	170	1,440	-	100	1,710
161kV SC Tubular Steel, 5-10 Deg.	-	170	1,440	-	100	1,710
161kV SC Tubular Steel, 10-20 Deg.	-	405	1,830	-	100	2,335
161kV SC Tubular Steel, 20-30 Deg.	-	405	1,830	-	100	2,335
161kV SC Steel Vert. Deadend, 30-45 Deg.	-	390	9,270	-	100	9,760
161kV SC Steel Vert. Deadend, 45-60 Deg.	-	390	9,270	-	100	9,760
161kV SC Steel Vert. Deadend, 60-75 Deg.	-	390	9,270	-	100	9,760
161kV SC Steel Vert. Deadend, 75-90 Deg.	-	390	7,620	-	100	8,110
161kV SC Steel Vert. Deadend, Terminal	-	390	9,270	-	100	9,760
161kV SC Steel H-Frame, In-Line Deadend	-	390	9,060	-	200	9,650
161kV SC Steel H-Frame Angle Deadend	-	390	9,060	-	200	9,650

OHGW, OPGW & Conductor			Material Cost Per 1 Ckt. Mile	Labor Cost Per 1 Ckt. Mile	Installed Cost Per 1 Ckt. Mile
Conductor Type	Cost Per K Ft.	Material Multiplier (%)	Material Cost Per 1 Ckt. Mile	Labor Cost Per 1 Ckt. Mile	Installed Cost Per 1 Ckt. Mile
1/2" OHGW	\$ 350	200	\$ 1,848	\$ 3,696	\$ 5,544
OPGW	\$ 1,800	80	\$ 9,504	\$ 7,603	\$ 17,107
(2) 795 ACSR Drake	1,270	26	\$ 40,234	31,382	71,616
(2) 1590 ACSR Lapwing	2,225	20	\$ 70,488	42,293	112,781



