

*Clair*



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DER - BAQM

July 25, 1989

Federal Express  
Airbill #7284301721

Mr. Claire Fancy  
Florida Department of  
Environmental Regulation  
Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, FL 32399-2440

Re: Hardee Power Station  
BACT Cost Analysis

Dear Mr. Fancy:

Enclosed, please find a copy of a BACT cost analysis for reducing NO<sub>x</sub> emissions from 65 ppm to 42 ppm while burning oil at the Hardee Power Station (HPS).

For the unlikely case of the HPS burning 100% fuel oil at a capacity factor of 100%, the cost per ton of NO<sub>x</sub> removed is \$4,937. When analyzing the \$/ton of NO<sub>x</sub> removed for HPS' likely fuel scenario of 80% natural gas and 20% fuel oil, the values are significantly higher. In any case, these values far exceed any \$/ton of NO<sub>x</sub> removal justified as BACT to date. We therefore believe that the analysis clearly shows that an emissions limit of 42 ppm while burning oil should not be considered BACT for the HPS.

Should you have any questions, please call.

Sincerely,

Jerry L. Williams  
Director  
Environmental

JLW/dsr/LL412.DOC

Enclosures

cc: Mr. Steve Smallwood, DER ✓  
Mr. Hamilton Oven, DER  
Mr. Barry Andrews, DER

TECO Power Services - Hardee Power Station  
 Additional Injection - 42 ppm gas and oil

Capacity factor	20	30	40	50	60	70	80	90	100
% Natural Gas firing	80	80	80	80	80	80	80	80	80
% No. 2 Fuel Oil firing	20	20	20	20	20	20	20	20	20
Annual Costs, \$X1000									
=====									
Direct Annual Cost									
Differential O&M Cost (2)	463	465	468	470	473	475	478	480	483
Energy (3)									
Heat Rate Penalty	379	568	757	947	1,136	1,325	1,515	1,704	1,893
Pump Power Consumption	8	13	17	21	25	29	34	38	42
Lost Generation Capacity	(229)	(229)	(229)	(229)	(229)	(229)	(229)	(229)	(229)
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Total Direct Cost	621	817	1,013	1,209	1,405	1,601	1,797	1,993	2,189
Indirect Annual Cost									
Capital Recovery (1)	545	545	545	545	545	545	545	545	545
Admin, Property Taxes, Insur	76	76	76	76	76	76	76	76	76
	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Indirect Annual Cost	621	621	621	621	621	621	621	621	621
Total Annual Cost	1242	1438	1634	1830	2026	2222	2418	2614	2810
NOx Emissions									
=====									
65ppm oil, tpy	265	397	530	662	795	927	1,060	1,192	1,325
42ppm oil, tpy	171	257	342	428	514	599	685	770	856
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Removed, tpy	94	141	187	234	281	328	375	422	469
Cost Effectiveness, \$/ton	13,250	10,228	8,717	7,810	7,206	6,774	6,450	6,199	5,997

TECO Power Services - Hardee Power Station  
 Additional Injection - 42 ppm gas and oil

Capacity factor	20	30	40	50	60	70	80	90	100
% Natural Gas firing	60	60	60	60	60	60	60	60	60
% No. 2 Fuel Oil firing	40	40	40	40	40	40	40	40	40

Annual Costs, \$X1000

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Direct Annual Cost

Differential O&M Cost (2)	925	930	936	941	946	951	956	961	966
Energy (3)									
Heat Rate Penalty	757	1,136	1,515	1,893	2,272	2,651	3,029	3,408	3,786
Pump Power Consumption	17	25	34	42	50	59	67	75	84
Lost Generation Capacity	(458)	(458)	(458)	(458)	(458)	(458)	(458)	(458)	(458)
	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Direct Cost	1,241	1,634	2,026	2,418	2,810	3,202	3,594	3,986	4,378

Indirect Annual Cost

Capital Recovery (1)	545	545	545	545	545	545	545	545	545
Admin, Property Taxes, Insur	76	76	76	76	76	76	76	76	76
	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Indirect Annual Cost	621	621	621	621	621	621	621	621	621

Total Annual Cost	1862	2255	2647	3039	3431	3823	4215	4607	4999
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NOx Emissions

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65ppm oil, tpy	530	795	1,060	1,325	1,590	1,854	2,119	2,384	2,649
42ppm oil, tpy	342	514	685	856	1,027	1,198	1,370	1,541	1,712
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Removed, tpy	187	281	375	469	562	656	750	843	937

Cost Effectiveness, \$/ton	9,937	8,019	7,060	6,485	6,101	5,827	5,622	5,462	5,334
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TECO Power Services - Hardee Power Station  
 Additional Injection - 42 ppm gas and oil

Capacity factor	20	30	40	50	60	70	80	90	100
% Natural Gas firing	40	40	40	40	40	40	40	40	40
% No. 2 Fuel Oil firing	60	60	60	60	60	60	60	60	60
Annual Costs, \$X1000									
=====									
Direct Annual Cost									
Differential O&M Cost (2)	1,388	1,396	1,403	1,411	1,419	1,426	1,434	1,441	1,449
Energy (3)									
Heat Rate Penalty	1,136	1,704	2,272	2,840	3,408	3,976	4,544	5,112	5,680
Pump Power Consumption	25	38	50	63	75	88	101	113	126
Lost Generation Capacity	(687)	(687)	(687)	(687)	(687)	(687)	(687)	(687)	(687)
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Total Direct Cost	1,862	2,450	3,038	3,627	4,215	4,803	5,391	5,979	6,567
Indirect Annual Cost									
Capital Recovery (1)	545	545	545	545	545	545	545	545	545
Admin, Property Taxes, Insur	76	76	76	76	76	76	76	76	76
	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Indirect Annual Cost	621	621	621	621	621	621	621	621	621
Total Annual Cost	2483	3071	3660	4248	4836	5424	6012	6600	7188
NOx Emissions									
=====									
65ppm oil, tpy	795	1,192	1,590	1,987	2,384	2,782	3,179	3,576	3,974
42ppm oil, tpy	514	770	1,027	1,284	1,541	1,798	2,054	2,311	2,568
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Removed, tpy	281	422	562	703	843	984	1,125	1,265	1,406
Cost Effectiveness, \$/ton	8,832	7,283	6,508	6,043	5,733	5,512	5,346	5,217	5,113

TECO Power Services - Hardee Power Station  
 Additional Injection - 42 ppm gas and oil

Capacity factor	20	30	40	50	60	70	80	90	100
% Natural Gas firing	20	20	20	20	20	20	20	20	20
% No. 2 Fuel Oil firing	80	80	80	80	80	80	80	80	80
Annual Costs, \$X1000									
=====									
Direct Annual Cost									
Differential O&M Cost (2)	1,851	1,861	1,871	1,881	1,891	1,902	1,912	1,922	1,932
Energy (3)									
Heat Rate Penalty	1,515	2,272	3,029	3,786	4,544	5,301	6,058	6,816	7,573
Pump Power Consumption	34	50	67	84	101	117	134	151	168
Lost Generation Capacity	(916)	(916)	(916)	(916)	(916)	(916)	(916)	(916)	(916)
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Total Direct Cost	2,483	3,267	4,051	4,835	5,620	6,404	7,188	7,972	8,757
Indirect Annual Cost									
Capital Recovery (1)	545	545	545	545	545	545	545	545	545
Admin, Property Taxes, Insur	76	76	76	76	76	76	76	76	76
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Total Indirect Annual Cost	621	621	621	621	621	621	621	621	621
Total Annual Cost	3104	3888	4672	5457	6241	7025	7809	8593	9378
NOx Emissions									
=====									
65ppm oil, tpy	1,060	1,590	2,119	2,649	3,179	3,709	4,239	4,769	5,298
42ppm oil, tpy	685	1,027	1,370	1,712	2,054	2,397	2,739	3,082	3,424
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Removed, tpy	375	562	750	937	1,125	1,312	1,500	1,687	1,874
Cost Effectiveness, \$/ton	8,280	6,914	6,232	5,822	5,549	5,354	5,208	5,094	5,003

TECO Power Services - Hardee Power Station  
 Additional Injection - 42 ppm gas and oil

Capacity factor	20	30	40	50	60	70	80	90	100
% Natural Gas firing	0	0	0	0	0	0	0	0	0
% No. 2 Fuel Oil firing	100	100	100	100	100	100	100	100	100
Annual Costs, \$X1000									
=====									
Direct Annual Cost									
Differential O&M Cost (2)	2,313	2,326	2,339	2,352	2,364	2,377	2,390	2,402	2,415
Energy (3)									
Heat Rate Penalty	1,893	2,840	3,786	4,733	5,680	6,626	7,573	8,520	9,466
Pump Power Consumption	42	63	84	105	126	147	168	189	210
Lost Generation Capacity	(1,145)	(1,145)	(1,145)	(1,145)	(1,145)	(1,145)	(1,145)	(1,145)	(1,145)
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Total Direct Cost	3,103	4,084	5,064	6,044	7,025	8,005	8,985	9,965	10,946
Indirect Annual Cost									
Capital Recovery (1)	545	545	545	545	545	545	545	545	545
Admin, Property Taxes, Insur	76	76	76	76	76	76	76	76	76
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Total Indirect Annual Cost	621	621	621	621	621	621	621	621	621
Total Annual Cost	3725	4705	5685	6665	7646	8626	9606	10586	11567
NOx Emissions									
=====									
65ppm oil, tpy	1,325	1,987	2,649	3,312	3,974	4,636	5,298	5,961	6,623
42ppm oil, tpy	856	1,284	1,712	2,140	2,568	2,996	3,424	3,852	4,280
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Removed, tpy	469	703	937	1,172	1,406	1,640	1,874	2,109	2,343
Cost Effectiveness, \$/ton	7,948	6,694	6,066	5,690	5,439	5,259	5,125	5,020	4,937

NOTE:

Based on a Total Capital Investment of \$3,533,000 with a project specific capital recovery factor of 15.42% Administrative costs, property taxes, and insurance utilize a factor of 2.16% of Total Capital Investment. The sum of these two factors represent the project specific fixed charge rate of 17.58%.

2. Differential O&M includes BOP maintenance and water treatment chemical costs. Inspection intervals decrease from 6500 operating hours to 1500 operating hours. This increases maintenance \$2,288,000 per year of 100% oil firing.
3. Energy includes increased BOP power consumption as well as a 1.2% CC heat rate penalty for the additional injection. The additional fuel cost associated with heat rate penalty utilizes Tampa Electric Company's current levelized fuel cost of \$14.49/MBtu for oil. Increased BOP power consumption is charged at \$124.03/MWh for oil.
4. Additional generation capacity is based on a 1.8% increase. An incremental levelized demand charge of \$81.64/kw/yr was utilized based on project specific parameters.

TECO Power Services - Hardee Power Station  
ADDITIONAL INJECTION (42 PPM ON OIL) CAPITAL COSTS (\$X1000)

Differential Combustion Turbine Costs	0
HRSG Modification	763
Water Treatment, Storage, and Injection Equipment	1,163
Foundations & BOP Equipment	288
Contingency (10%)	221
Subtotal	2,434
Sales Tax (6%)	146
Indirect costs (14.5%)	353
Subtotal	2,933
Escalation (4.7%)	205
Total Escalated Cost	3,138
Interest During Construction	395
Total Capital Investment	3,533