TAMPA ELECTRIC
A TECO ENERGY COMPANY

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July 17, 1990

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:

As discussed in our meeting on July 11, 1990, I have included a copy of a Hardee Power Station (HPS) BACT cost analysis for NO_x that is based on work done by the Department of Environmental Regulation (DER) for the HPS certification report. This analysis uses data provided by DER as follows:

- 80% NO_x reduction using SCR
- 3 year SCR catalyst replacement for SCR
- 3,364 tons of NO_x removed annually, based on 100% firing of natural gas
- $3,592/ton cost of NO_x removed.

Although the applicants do not necessarily agree with the DER's assumptions, they have been included in this analysis for illustrative purposes. This analysis shows that the cost per ton of NO_x removed while burning 100% natural gas at a 100% capacity factor is $3,592. For a case of burning natural gas only at a capacity factor of 80%, the cost per ton of NO_x removed is over $4,000. This value far exceeds any $/ton of NO_x removal justified as BACT to date.

When analyzing the $/ton of NO_x removed for HPS' likely fuel combustion scenario of 80% natural gas and 20% fuel oil, the values are significantly higher.

As discussed in our meeting, we believe that these analyses, using DER's assumptions, clearly show that SCR should not be considered BACT for the HPS.

Sincerely,

Jerry L. Williams
Director
Environmental

JLW/ams/LL404.DOC

cc: Mr. Steve Smallwood, DER (w/enc.)
Mr. Hamilton Oven, DER (w/enc.)
Mr. Barry Andrews, DER (w/enc.)

Enclosure

TECO Power Services - Hardee Power Station
SCR - THREE YEAR CATALYST REPLACEMENT

Capacity factor	20	25	40	50	80	85	86.41	90	100
% Natural Gas firing	100	100	100	100	100	100	100	100	100
% No. 2 Fuel Oil firing	0	0	0	0	0	0	0	0	0
Annual Costs, $X1000									
Direct Annual Cost									
Differential O&M Cost (2)	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490
Ammonia (3)	120	150	240	300	480	510	518	540	600
Energy (4)									
Heat Rate Penalty	342	428	685	856	1,369	1,455	1,479	1,540	1,711
SCR Power Consumption	209	262	419	524	838	890	905	942	1,047
Lost Generation Capacity (5)	370	370	370	370	370	370	370	370	370
Total Direct Annual Cost	4,532	4,700	5,203	5,539	6,547	6,715	6,762	6,883	7,219
Indirect Annual Cost									
Capital Recovery (1)	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268
Admin, Property Taxes, and Insurance	598	598	598	598	598	598	598	598	598
Total Indirect Annual Cost	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866
Total Annual Cost	9,398	9,566	10,070	10,405	11,413	11,581	11,628	11,749	12,085
NOx Emissions									
42ppm natural gas, tpy	841	1,051	1,682	2,103	3,364	3,574	3,634	3,785	4,205
9ppm natural gas, tpy	168	210	336	421	673	715	727	757	841
Removed, tpy	673	841	1,346	1,682	2,691	2,859	2,907	3,028	3,364
Cost Effectiveness, $/ton	13,968	11,374	7,483	6,186	4,241	4,050	4,000	3,881	3,592

TECO Power Services - Hardee Power Station
SCR - THREE YEAR CATALYST REPLACEMENT

Capacity factor	20	25	40	50	80	85	86.41	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)	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490
Ammonia (3)	96	120	192	240	384	408	415	432	480
Energy (4)									
Heat Rate Penalty	359	448	717	896	1,434	1,524	1,549	1,614	1,793
SCR Power Consumption	168	209	335	419	670	712	724	754	838
Lost Generation Capacity (5)	370	370	370	370	370	370	370	370	370
Total Direct Annual Cost	4,482	4,638	5,104	5,415	6,348	6,504	6,548	6,659	6,971
Indirect Annual Cost									
Capital Recovery (1)	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268
Admin, Property Taxes, and Insurance	598	598	598	598	598	598	598	598	598
Total Indirect Annual Cost	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866
Total Annual Cost	9,348	9,504	9,970	10,281	11,215	11,370	11,414	11,526	11,837
NOx Emissions									
42ppm natural gas, tpy	673	841	1,346	1,682	2,691	2,859	2,907	3,028	3,364
9ppm natural gas, tpy	135	168	269	336	538	572	581	606	673
Removed, tpy	538	673	1,076	1,346	2,153	2,288	2,325	2,422	2,691
Cost Effectiveness, $/ton	17,368	14,126	9,262	7,641	5,209	4,970	4,908	4,759	4,398

TECO Power Services - Hardee Power Station
SCR - THREE YEAR CATALYST REPLACEMENT

Capacity factor	20	25	40	50	80	85	86.41	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									
Direct Annual Cost									
Differential O&M Cost (2)	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490	3,490
Ammonia (3)	72	90	144	180	288	306	311	324	360
Energy (4)									
Heat Rate Penalty	375	469	750	937	1,499	1,593	1,620	1,687	1,874
SCR Power Consumption	126	157	251	314	503	534	543	565	628
Lost Generation Capacity (5)	370	370	370	370	370	370	370	370	370
Total Direct Annual Cost	4,433	4,576	5,005	5,291	6,150	6,293	6,334	6,436	6,723
Indirect Annual Cost									
Capital Recovery (1)	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268	4,268
Admin, Property Taxes, and Insurance	598	598	598	598	598	598	598	598	598
Total Indirect Annual Cost	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866	4,866
Total Annual Cost	9,299	9,442	9,871	10,157	11,016	11,159	11,200	11,302	11,589
NOx Emissions									
42ppm natural gas, tpy	505	631	1,009	1,262	2,018	2,145	2,180	2,271	2,523
9ppm natural gas, tpy	101	126	202	252	404	429	436	454	505
Removed, tpy	404	505	807	1,009	1,615	1,716	1,744	1,817	2,018
Cost Effectiveness, $/ton	23,035	18,711	12,226	10,065	6,822	6,504	6,421	6,222	5,742

TECO Power Services - Hardee Power Station
SCR CAPITAL COST$ ($X1000)

SCR Reactor	12,750
SCR Auxilliaries and Ammonia Storage	1,500
SCR Erection	2,625
Foundations, Ammonia System Erection & BOP Equipment	450
Contingency (10%)	1,733
Subtotal	19,058
Sales Tax (6%)	1,143
Indirect costs (14.5%)	2,763
Subtotal	22,964
Escalation (4.7%)	1,620
Total Escalated Cost	24,584
Interest During Construction	3,095
Total Capital Investment	27,679

NOTE:

1. Based on a Total Capital Investment of $27,680,000 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 maintenance & labor and catalyst replacement. Complete replacement after 3 years.
3. Ammonia cost is based on $250/ton and a stoichmetric ratio of 1.2.
4. Energy includes auxilliary power for the SCR as well as a 0.42% CT heat rate penalty for the SCR. The additional fuel cost associated with heat rate penalty utilizes Tampa Electric Company's (TEC) current levelized fuel cost forecast of $11.68/MBtu for natural gas and $14.49 for oil. Increased BOP power consumption is charged at $99.98/MWh. This latter factor also utilized the TEC fuel cost forecast.
5. The SCR lost generation capacity is based on an 0.42% penalty. An incremental levelized demand charge of $81.64/kW/yr was utilized based on project specific parameters.
6. SCR removal efficiency is assumed to be 80%.
7. Ammonia feed is assumed to be off when unit is being fired with oil.