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August 28, 2007

Jonathan Holtom, P.E.  
North Permitting Section  
Florida Department of Environmental Protection  
Bob Martinez Center  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

**Re:** 2<sup>nd</sup> Request for Additional Information Regarding BART Application For Crystal River Power Plant; Construction Permit Project No. 0170004-017-AC

Dear Mr. Holtom,

Progress Energy Florida (PEF) is in receipt of the Department's July 27, 2007 2<sup>nd</sup> request for additional information (RAI) related to the June 27, 2007 Best Available Retrofit Technology (BART) RAI response package submitted for Crystal River Units 1 and 2. The following responses (in bold italic type) are provided to the comments in the order in which they were received.

1. Please resubmit the cost-effectiveness evaluations contained in the first response using an interest rate of 7 percent and a useful life of 20 years instead of 10 percent and 10 years.

***Regarding the Department's suggestion to change the interest rate used in the analysis from 10 percent to 7 percent, PEF has attached a guidance document from the Office of Air Quality Planning and Standards (OAQPS), dated July 24, 1987 (Attachment 1). This document was meant to provide clarification regarding the appropriate criteria to be used in calculating the amortized capital costs of control options in the selection of best available control technology (BACT). The document states that the appropriate annual interest (discount) rate to use in these analyses is 10 percent, as recommended by the Office of Management and Budget. While this guidance may be dated and other more recent BACT determinations have been conducted with an assumed 7 percent interest rate, it should be pointed out that BACT is not BART. A distinction between BACT and BART is that the former is typically applied to new greenfield projects, while the latter applies to existing equipment. Other BART applications have been submitted with costs based on their current cost of capital or the actual cost of borrowing money (i.e., ranging from 8.1 to 10 percent) and a 10 year life (based on corrosive nature of the process). PEF has attached revised cost tables (Attachment 2, Tables 1 through 8) that reflect a 7 percent interest rate, but believes this to be unrealistic based on PEF's current cost of borrowing money.***

***Regarding revising the economic useful life of the ESP and baghouse control equipment from 10 to 20 years, there is some precedence for using 20 years (see Attachment 1). PEF's belief and experience with this kind of equipment would tend to support a useful life closer to 10 years, but will assume a 20***

*year life for purposes of this analysis. As stated above, PEF has attached revised cost tables (Attachment 2) that reflect the Department's requested assumptions of 7 percent interest and 20 year equipment life, although, as stated, PEF is not in agreement with the appropriateness of these assumptions.*

*It should be noted that the purpose of the BART program is to effect visibility improvement. PEF's June 27, 2007 submittal provided documentation indicating that, for all control cases considered, the visibility improvement was minimal and the resulting \$/dV reduced was prohibitive (i.e., greater than \$46 million per deciview improvement). While the interest rate and equipment life adjustments requested by the Department have the effect of lowering the cost-effectiveness on a \$/ton reduced basis, they have very little effect on the cost-effectiveness of visibility improvement (i.e., \$/dV reduced). Attachment 3 presents a summary of the revised analyses results. Table 3-1 is a summary of the revised cost-effectiveness (dollars per ton PM reduced) and Table 3-2 provides a summary of the critical cost-effectiveness parameter for BART (i.e., dollars per deciview improvement).*

2. In your response, you state that Progress Energy believes the lowest continuously achievable emission rate is the current permit limit of 0.1 lb/MMBtu. Therefore, please also submit new cost-effectiveness evaluations based on tons of PM removed starting from the limit of 0.1 lb/MMBtu down to the achievable rate of each of the different options, rather than starting from the current tested emissions rates. For these cost-effectiveness evaluations, please use an interest rate of 7 percent and a useful life of 20 years.

*PEF believes that the Department has mis-characterized the above response. The Department had requested PEF's opinion on the "lowest, continuously achievable" emission rate. As the Department knows, PM emissions are not continuously monitored. Given the current method of demonstrating PM compliance (i.e., annual stack testing), PEF believes that the analysis' reliance on the highest actual PM test results over the last 5-year period provides a representative annual average value for the analysis. However, with respect to the appropriateness of a continuous short-term limit, operations and coal types on an annual basis are highly variable.*

*The EPA BART guidance indicates that the emission rate to be used for BART modeling is the highest 24-hour actual emission rate representative of normal operations for the modeling period. Further, for consistency, the BART modeling and BART control technology assessments should use the same set of underlying assumptions. Depending on the availability of the source data, the source emissions information should be based on the following in order of priority, based on the BART common protocol:*

- *24-hour maximum emissions based on continuous emission monitoring (CEM) data for the period 2001-2003;*
- *Facility stack test emissions;*
- *Potential to emit;*
- *Allowable permit limits; and*
- *AP-42 emission factors.*

*Therefore, as CEMS data is not available in this case, the above BART hierarchy would recommend the use of stack test data over the use of allowable emission limits. PEF believes that the existing PM emission limit of 0.1 lb/MMBtu, continues to be appropriate as a short-term limit to be complied with under all anticipated operating conditions, and is continuously achievable. Given this background,*

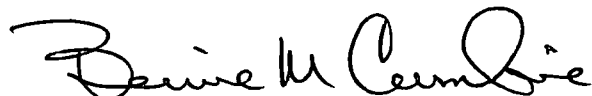
Mr Holtom  
August 28, 2007  
Page 3

***PEF does not agree that the short-term limit of 0.1 lb/MMBtu should be used to determine annual emissions for the purpose of this analysis.***

As these responses are providing additional information of an engineering nature, a State of Florida professional engineering certification has also been provided, in accordance with Rule 62-4.050(3), F.A.C. In addition, the appropriate Responsible Official certification page has been signed and included in this submittal.

Should you have any question regarding these responses or need additional information, please contact Dave Meyer at (727) 820-5295 or Scott Osbourn at (813) 287-1717.

Sincerely,



Bernie M. Cumbie  
Plant Manager/Responsible Official

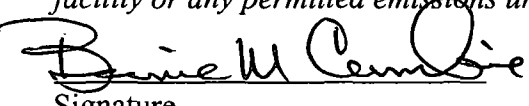
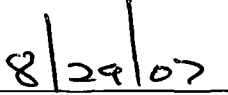
Attachments

cc: Dave Meyer, Progress Energy Florida, Inc. (Dave.Meyer@pgnmail.com)  
Scott Osbourn, P.E., Golder Associates (sosbourn@golder.com)  
Ms. Cindy Zhang-Torres, P.E., DEP - SWD (cindy.zhang-torres@dep.state.fl.us)  
Gregg Worley, EPA Region 4 (worley.gregg@epa.gov)  
Dee Morse, National Parks Service (Dee\_Morse@nps.gov)

## APPLICATION INFORMATION

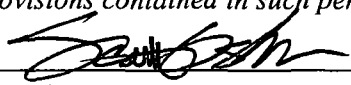
### Owner/Authorized Representative Statement

**Complete if applying for an air construction permit or an initial FESOP.**

1. Owner/Authorized Representative Name : <b>Bernie Cumbie, Plant Manager</b>
2. Owner/Authorized Representative Mailing Address... Organization/Firm: <b>Progress Energy</b> Street Address: <b>100 Central Ave CN 77</b> City: <b>St. Petersburg</b> State: <b>Florida</b> Zip Code: <b>33701</b>
3. Owner/Authorized Representative Telephone Numbers... Telephone: <b>(352) 563 - 4484</b> ext. Fax: <b>(352) 563 - 4496</b>
4. Owner/Authorized Representative Email Address: <b>Bernie.cumbie@pgnmail.com</b>
5. Owner/Authorized Representative Statement:  <i>I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.</i>   Signature   Date

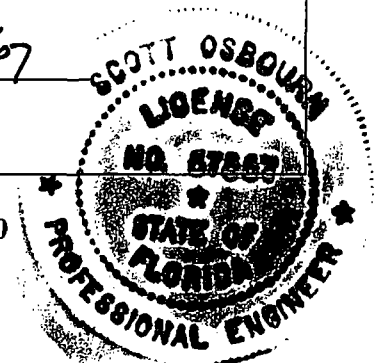
## APPLICATION INFORMATION

### Professional Engineer Certification

1. Professional Engineer Name: <b>Scott Osbourn</b> Registration Number: <b>57557</b>
2. Professional Engineer Mailing Address... Organization/Firm: <b>Golder Associates Inc.**</b> Street Address: <b>5100 Lemon Street, Suite 114</b> City: <b>Tampa</b> State: <b>FL</b> Zip Code: <b>33609</b>
3. Professional Engineer Telephone Numbers... Telephone: <b>(813) 287 - 1717</b> ext. 211 Fax: <b>(813) 287 - 1716</b>
4. Professional Engineer Email Address: <b>sosbourn@golder.com</b>
5. Professional Engineer Statement: <i>I, the undersigned, hereby certify, except as particularly noted herein*, that:</i>  (1) <i>To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and</i>  (2) <i>To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.</i>  (3) <i>If the purpose of this application is to obtain a Title V air operation permit (check here <input type="checkbox"/>, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.</i>  (4) <i>If the purpose of this application is to obtain an air construction permit (check here <input checked="" type="checkbox"/>, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here <input type="checkbox"/>, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.</i>  (5) <i>If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here <input type="checkbox"/>, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.</i>  <div style="display: flex; justify-content: space-between;"><div>Signature  (seal)</div><div>Date <u>8/27/07</u></div></div>

\* Attach any exception to certification statement.

\*\* Board of Professional Engineers Certificate of Authorization #00001670



**ATTACHMENT 1**  
**OAQPS Guidance Document**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
Office of Air Quality Planning and Standards  
Research Triangle Park North Carolina 27711

JUL 24 1987

MEMORANDUM

SUBJECT: Calculating Amortized Capital Costs

FROM: Robert D. Bauman, Chief  
Standards Implementation Branch, CPDD (MD-15)

TO: Stephen H. Rothblatt, Chief  
Air and Radiation Branch, Region V (5AR-26)

This is in response to your April 21, 1987, memorandum requesting clarification regarding the appropriate criteria to be used in calculating the amortized capital costs of control options in the selection of best available control technology (BACT). The 1980 "Prevention of Significant Deterioration Workshop Manual" states that U.S. Internal Revenue Service (IRS) criteria should be used to determine equipment life expectancy. However, EPA, in developing new source performance standards (NSPS), uses economic assumptions based on "useful economic life." You wish to know which set of criteria to use in the BACT economic analysis.

The EPA still relies on IRS criteria, but there are now several different IRS equipment life estimation systems and several EPA equipment life information sources based on IRS data, so it is more difficult now to know what information to use. Our policy is that unless the source can offer compelling data to the contrary, the useful life of a control option should be selected from one of the following:

- \* For process-related controls, use:
  - the NSPS/national emission standard for hazardous air pollutants (NESHAP) Background Information Document (if a source is subject to an NSPS or NESHAP), or
  - the IRS Class Life Asset Depreciation Range (CLADR) system guideline with a mid-point estimate (if no NSPS/NESHAP applies).
- \* For "add-on" controls, use the Economic Analysis Branch Control Cost Manual, which is based on CLADR data.

Regarding the appropriate annual interest ("discount") rate to use in these analyses, the Office of Management and Budget (OMB) guidelines recommend 10 percent for regulatory impact analyses. Because all NSPS are submitted to OMB for review, we have typically used 10 percent in our

analyses. However, this value represents a very high rate of return because it is a "real" discount rate (i.e., it does not incorporate inflation). The OMB has assembled a task force which is now studying this matter and will likely recommend a substantially lower value to be used in future EPA risk assessment analyses; we plan to use the lower value when and if it is adopted.

The two attachments provide additional information on the economic life criteria discussed above. I hope this memorandum clarifies the BACT guidance in this area. If you have any questions about it, please feel free to contact me at FTS 629-5629 or David Solomon at FTS 629-5375.

2 Attachments

cc: NSR Contacts



### Background Information on Capital Cost Criteria

When the 1980 "Prevention of Significant Deterioration Workshop Manual" stated that the U.S. Internal Revenue Service (IRS) criteria should be used to determine equipment life standards, it was referring to the IRS "Class Life Asset Depreciation Range" (CLADR) system which provides a range of depreciation periods for each class of assets. Although the CLADR system was repealed for tax purposes for property placed in service after 1980, these guidelines still provide estimates of low, medium, and high useful lives for depreciable assets used in a wide range of business, industrial, and other activities. The CLADR should not be confused with the current IRS rules for the Accelerated Cost Recovery System (ACRS). The ACRS is not recommended for equipment life expectancy because it uses "recovery periods" which, for many types of equipment, are considerably less than actual useful equipment life.

In our opinion, the "useful economic life" criterion using CLADR data is the most realistic one to use when estimating the amortized capital ("capital recovery") costs for control options, be they "add-on" or process-related controls. The only exception should be if documentation, proving that the equipment life is shorter, is provided. The CLADR provides a range of estimates; we recommend using the mid-point CLADR life to obtain the best estimate of "useful economic life."

Under CLADR, "useful economic life" may vary not only with the type of equipment but also with where and how that equipment is being used. Consider a gas turbine installed in an industrial facility for purposes of generating (or cogenerating) electricity for consumption on site. If the total rated capacity for electrical production/distribution at the site were greater than 500 kilowatts (KW), the turbine would fall under "Asset Guideline Class (AGC)"00.4:" Industrial Steam and Electric Generation and/or Distribution Systems. The "asset depreciation range" for this class provides a lower limit of 17.5 years, a mid-point of 22 years, and an upper limit of 26.5 years. However, if this turbine is installed at, say, a plant producing breakfast food and the electrical production/distribution capacity at this facility is less than 500 kW, the lives to use would be 13.5 (low), 17 (mid-point), and 20.5 years (high) (AGC 20.1, "Manufacture of Grain and Mill Products"). A complete listing of the CLADR values can be found in IRS Publication 534.

Ideally, all control options should be amortized using useful lives that are not only representative but standardized. The IRS CLADR meets both requirements in this respect, as do the background information documents (BID) written to support the setting of new source performance standards and national emission standards for hazardous air pollutants. A BID's cost and economic analyses contain useful life data for the source category subject to the standard. These life data have been based, in turn, on information obtained from the industry (e.g., via section 114 letters), control equipment vendors, and other reliable sources.

It may prove difficult in some cases to determine useful life of add-on control equipment in the IRS listings. Accordingly, EPA has tabulated low, midpoint, and high economic lives for eight commonly used add-on control devices (see attachment). These data were taken from Capital and Operating Costs of Selected Air Pollution Control Systems (EPA 450/5-80-002, December 1978). This report, now retitled the Economic Analysis Branch Control Cost Manual (Third Edition), is being revised; for a copy, contact Bill Vataavuk at (FTS) 629-5309.

Attachment

TABLE 3.6 GUIDELINES FOR PARTS AND EQUIPMENT [SEE FOOTNOTE \*]

<u>MATERIALS AND PARTS LIFE</u>	<u>LOW (Years)</u>	<u>AVERAGE (Years)</u>	<u>HIGH (Years)</u>
Filter bags	.3	1.5	5
Adsorbents	2	5	8
Catalyst <sup>2</sup>	5	8	8
Refractories	1	5	10

EQUIPMENT LIFE

Electrostatic Precipitators	5	20	40
Venturi Scrubbers	5	10	20
Fabric Filters	5	20	40
Thermal Incinerators	5	10	20
Catalytic Incinerators	5	10	20
Adsorbers	5	10	20
Absorbers	5	10	20
Refrigeration	5	10	20
Flares	5	15	20

[FOOTNOTE\*]Based on discussions with manufacturers and operators with corroborating data from refs. 19, 20, 37, 38, 40, 78 and 82.

Source: Capital and Operating Costs of Selected Air Pollution Control Systems (EPA 450/5-80-002, December 1978).

## **ATTACHMENT 2**

### **Revised Control Cost Tables**

**TABLE 1 -ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 1 - Rebuild ESP	Electrostatic Precipitator	PM10

### TOTAL CAPITAL COST FOR ELECTROSTATIC PRECIPITATOR-REBUILD

#### DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$3,631,300
(b) Instrumentation (0.10 A)	\$363,130
(c) Freight and Taxes (0.08 A)	\$290,504
Total Equipment Cost (B):	\$4,284,934
(2) Direct Installation Costs:	
(b) Erection and Handling (2.50 B)	\$10,712,335
(b) Deconstruction (0.01 B)	\$42,849
Total Installation Cost (C)	\$10,755,184
Total Direct Costs of Capital Investment (DCCI) = (B + C)	\$15,040,118

#### INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.20 B)	\$856,987
(2) Construction and Field Expenses (0.20 B)	\$856,987
(3) Contractor Fees (0.10 B)	\$428,493
(4) Startup (0.01 B)	\$42,849
(5) Performance Test (0.01 B)	\$42,849
(6) Contingencies (0.03 B)	\$128,548
Total Indirect Costs of Capital Investment (ICCI)	\$2,356,714

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$17,396,832

#### ANNUALIZED COST OF CAPITAL INVESTMENT

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X TCB)	\$1,642,100

**TABLE 1 -ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 1 - Rebuild ESP	Electrostatic Precipitator	PM10

**TOTAL ANNUAL O&M COST FOR ELECTROSTATIC PRECIPITATOR – REBUILD**

**DIRECT COSTS (O&M):**

(1) Variable Costs

(a) Utilities

(a1) Electricity - Cost: 0.0000 \$/kW (No additional electricity consumption)  
Rate: 0 kW/yr

\$0

(b) Landfill Costs

(b1) Dust Volume: 370.4 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$10,557

Total Direct Variable Costs (D)

\$10,557

(2) Semivariable Costs (considered equivalent to semivariable costs without rebuild)=0

(a) Labor

O = \$26.00 M = \$34.00

(a1) Operating (O) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$26.00/hr)

\$0

(a2) Supervisory (0.15 O)

\$0

(a3) Maintenance (M) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$34.00/hr)

\$0

(b) Maintenance Materials (M) (1% of Purchased Equipment Costs)

\$0

(c) Replacement Parts

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$0

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$0

(c3) Interest rate (i)

10%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.26

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$0

Total Semivariable Costs (E)

\$0

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$10,557

**INDIRECT COSTS (O&M):(Equivalent without rebuild)=0**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$0

(2) Property Tax (0.01 TCI)

\$0

(3) Insurance (0.01 TCI)

\$0

(4) Administration (0.02 TCI)

\$0

Total Annual Indirect Costs of O&M (ICO&M)

\$0

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$10,557

**COST EFFECTIVENESS OF ELECTROSTATIC PRECIPITATOR REBUILD**

Capital Recovery Cost of Equipment (CRC)		\$1,642,100
Total Annual Costs of O&M (TAO&M)		<u>\$10,557</u>
Total Annualized Cost (TAC) = (CRC + TAO&M)		\$1,652,657
Control Device Loading Rate (F)	tons/yr	119,929.2
Control Device efficiency improvement (G)		0.3% To meet 0.015
Pollutant Removed (H) = (F X G)		378.3
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed	<b>\$4,368.63</b>

**TABLE 2 - ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 2 - Rebuild ESP	Electrostatic Precipitator	PM10

### TOTAL CAPITAL COST FOR ELECTROSTATIC PRECIPITATOR-REBUILD

#### DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$2,372,000
(b) Instrumentation (0.10 A)	\$237,200
(c) Freight and Taxes (0.08 A)	\$189,760
Total Equipment Cost (B):	\$2,798,960

(2) Direct Installation Costs:	
(b) Erection and Handling (2.50 B)	\$6,997,400
(b) Deconstruction (0.01 B)	\$27,990
Total Installation Cost (C)	\$7,025,390

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$9,824,350

#### INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.20 B)	\$559,792
(2) Construction and Field Expenses (0.20 B)	\$559,792
(3) Contractor Fees (0.10 B)	\$279,896
(4) Startup (0.01 B)	\$27,990
(5) Performance Test (0.01 B)	\$27,990
(6) Contingencies (0.03 B)	\$83,969
Total Indirect Costs of Capital Investment (ICCI)	\$1,539,428

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$11,363,778

#### ANNUALIZED COST OF CAPITAL INVESTMENT

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X TCB)	\$1,072,700

**TABLE 2 - ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 2 - Rebuild ESP	Electrostatic Precipitator	PM10

**TOTAL ANNUAL O&M COST FOR ELECTROSTATIC PRECIPITATOR – REBUILD**

**DIRECT COSTS (O&M):**

**(1) Variable Costs**

**(a) Utilities**

(a1) Electricity - Cost: 0.0000 \$/kW (No additional electricity consumption)  
Rate: 0 kW/yr

\$0

**(b) Landfill Costs**

(b1) Dust Volume: 189.6 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$5,404

**Total Direct Variable Costs (D)**

\$5,404

**(2) Semivariable Costs (considered equivalent to semivariable costs without rebuild)=0**

**(a) Labor**

O = \$26.00 M = \$34.00

(a1) Operating (O) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$26.00/hr)

\$0

(a2) Supervisory (0.15 O)

\$0

(a3) Maintenance (M) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$34.00/hr)

\$0

**(b) Maintenance Materials (M) (1% of Purchased Equipment Costs)**

\$0

**(c) Replacement Parts**

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$0

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$0

(c3) Interest rate (i)

10%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.26

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$0

**Total Semivariable Costs (E)**

\$0

**Total Annual Direct Cost of O&M (DCO&M) = (D + E)**

\$5,404

**INDIRECT COSTS (O&M): (Equivalent without re-build)=0**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$0

(2) Property Tax (0.01 TCI)

\$0

(3) Insurance (0.01 TCI)

\$0

(4) Administration (0.02 TCI)

\$0

**Total Annual Indirect Costs of O&M (ICO&M)**

\$0

**TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):**

\$5,404

**COST EFFECTIVENESS OF ELECTROSTATIC PRECIPITATOR REBUILD**

Capital Recovery Cost of Equipment (CRC)		\$1,072,700
Total Annual Costs of O&M (TAO&M)		\$5,404
Total Annualized Cost (TAC) = (CRC + TAO&M)		\$1,078,104
Control Device Loading Rate (F)	tons/yr	123,660.4
Control Device efficiency improvement (G)		0.18%
Pollutant Removed (H) = (F X G)		216.6
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed	\$4,976.60

To meet 0.015



**TABLE 3 - ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 1	Electrostatic Precipitator	PM10

**TOTAL CAPITAL COST FOR REPLACEMENT ELECTROSTATIC PRECIPITATOR**

**DIRECT COSTS (capital investment)**

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$18,172,668
(b) Instrumentation (0.10 A)	\$1,817,267
(c) Freight and Taxes (0.08 A)	\$1,453,813
Total Equipment Cost (B):	<u>\$21,443,748</u>
(2) Direct Installation Costs:	
(a) Foundations and Supports (0.04 B)	\$857,750
(b) Erection and Handling	\$41,571,795
(c) Electrical (0.08 B)	\$1,715,500
(d) Piping (0.01 B)	\$214,437
(e) Insulation for ductwork (0.02 B)	\$428,875
(f) Painting (0.02 B)	\$428,875
(g) Building and Site Preparation (0.01 B)	\$214,437
Total Installation Cost (C) (2.5A)	<u>\$45,431,670</u>

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$66,875,418

**INDIRECT COSTS (capital investment):**

(1) Engineering Costs (included in A)	
(2) Construction and Field Expenses (included in C)	
(3) Contractor Fees (included in C)	
(4) Startup (0.01 B)	\$214,437
(5) Performance Test (0.01 B)	\$214,437
(6) Contingencies (0.03 B)	\$643,312
Total Indirect Costs of Capital Investment (ICCI)	<u>\$1,072,187</u>

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$67,947,606

**ANNUALIZED COST OF CAPITAL INVESTMENT**

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X TCB)	\$6,413,800

**TABLE 3 - ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 1	Electrostatic Precipitator	PM10

**TOTAL ANNUAL O&M COST FOR ELECTROSTATIC PRECIPITATOR**

**DIRECT COSTS (O&M):**

**(1) Variable Costs**

**(a) Utilities**

(a1) Electricity - Cost: 0.0000 \$/kW (Estimate)  
Rate: 0 kW/yr (No Additional Electricity Consumption)

\$0

**(b) Landfill Costs**

(b1) Dust Volume: 452.5 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$12,897

Total Direct Variable Costs (D)

\$12,897

**(2) Semivariable Costs ( Equivalent to replaced unit)=0**

(a) Labor O = \$26.00 M = \$34.00

(a1) Operating (O) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$26.00/hr)

\$0

(a2) Supervisory (0.15 O)

\$0

(a3) Maintenance (M) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$34.00/hr)

\$0

(b) Maintenance Materials (M) (1% of Purchased Equipment Costs)

\$0

**(c) Replacement Parts**

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$0

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$0

(c3) Interest rate (i)

10%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.264

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$0

Total Semivariable Costs (E)

\$0

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$12,897

**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$0

(2) Property Tax (0.01 TCI)

\$679,500

(3) Insurance (0.01 TCI)

\$679,500

(4) Administration (0.02 TCI)( Equivalent cost)=0

\$0

Total Annual Indirect Costs of O&M (ICO&M)

\$1,359,000

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$1,371,897

**COST EFFECTIVENESS OF ELECTROSTATIC PRECIPITATOR**

Capital Recovery Cost of Equipment (CRC)	\$6,413,800
Total Annual Costs of O&M (TAO&M)	\$1,371,897
Total Annualized Cost (TAC) = (CRC + TAO&M)	\$7,785,697
Control Device Loading Rate (F)	tons/yr 123,893.8
Control Device efficiency improvement (G)	0.4% To meet 0.010
Pollutant Removed (H) = (F X G)	452.5
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed \$17,204.38

**TABLE 4 -ELECTROSTATIC PRECIPITATOR COST DATA****CONTROL EQUIPMENT ANALYSIS****Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 2	Electrostatic Precipitator	PM10

**TOTAL CAPITAL COST FOR REPLACEMENT ELECTROSTATIC PRECIPITATOR****DIRECT COSTS (capital investment)**

## (1) Purchased Equipment Costs:

(a) Basic Equipment and Auxiliaries (A)	\$20,400,000
(b) Instrumentation (0.10 A)	\$2,040,000
(c) Freight and Taxes (0.08 A)	\$1,632,000

Total Equipment Cost (B):	<u>\$24,072,000</u>
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## (2) Direct Installation Costs:

(a) Foundations and Supports (0.04 B)	\$962,880
(b) Erection and Handling	\$46,667,040
(c) Electrical (0.08 B)	\$1,925,760
(d) Piping (0.01 B)	\$240,720
(e) Insulation for ductwork (0.02 B)	\$481,440
(f) Painting (0.02 B)	\$481,440
(g) Building and Site Preparation (0.01 B)	\$240,720

Total Installation Cost (C) (2.5A)	<u>\$51,000,000</u>
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Total Direct Costs of Capital Investment (DCCI) = (B + C)	\$75,072,000
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**INDIRECT COSTS (capital investment):**

## (1) Engineering Costs (included in A)

## (2) Construction and Field Expenses (included in C)

## (3) Contractor Fees (included in C)

(4) Startup (0.01 B)	\$240,720
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(5) Performance Test (0.01 B)	\$240,720
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(6) Contingencies (0.03 B)	<u>\$722,160</u>
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Total Indirect Costs of Capital Investment (ICCI)	<u>\$1,203,600</u>
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TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI):	\$76,275,600
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**ANNUALIZED COST OF CAPITAL INVESTMENT**

(1) Interest Rate	7.0%
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(2) Control System Economic Life (years)	20
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(3) Capital Recovery Factor (CRF)	0.094
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(4) Capital Recovery Cost (CRC) = (CRF X TCB)	\$7,199,900
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**TABLE 4 -ELECTROSTATIC PRECIPITATOR COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Source	Control Device	Pollutant
Coal Combustion Unit 2	Electrostatic Precipitator	PM10

**TOTAL ANNUAL O&M COST FOR ELECTROSTATIC PRECIPITATOR**

**DIRECT COSTS (O&M):**

**(1) Variable Costs**

**(a) Utilities**

(a1) Electricity - Cost: 0.0000 \$/kW (Estimate)  
Rate: 0 kW/yr (No Additional Electricity Consumption)

\$0

**(b) Landfill Costs**

(b1) Dust Volume: 406.8 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$11,594

Total Direct Variable Costs (D)

\$11,594

**(2) Semivariable Costs ( Equivalent to replaced unit)=0**

**(a) Labor**

O = \$26.00 M = \$34.00

(a1) Operating (O) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$26.00/hr)

\$0

(a2) Supervisory (0.15 O)

\$0

(a3) Maintenance (M) = (2 hrs/shift X 3 shifts/day X day/24hrs X 8,500 hrs/yr X \$34.00/hr)

\$0

**(b) Maintenance Materials (M) (1% of Purchased Equipment Costs)**

\$0

**(c) Replacement Parts**

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$0

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$0

(c3) Interest rate (i)

10%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.264

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$0

Total Semivariable Costs (E)

\$0

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$11,594

**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$0

(2) Property Tax (0.01 TCI)

\$762,800

(3) Insurance (0.01 TCI)

\$762,800

(4) Administration (0.02 TCI)( Equivalent cost)=0

\$0

Total Annual Indirect Costs of O&M (ICO&M)

\$1,525,600

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$1,537,194

**COST EFFECTIVENESS OF ELECTROSTATIC PRECIPITATOR**

Capital Recovery Cost of Equipment (CRC)		\$7,199,900
Total Annual Costs of O&M (TAO&M)		\$1,537,194
Total Annualized Cost (TAC) = (CRC + TAO&M)		\$8,737,094
Control Device Loading Rate (F)	tons/yr	135,253.5
Control Device efficiency improvement (G)		0.3% To meet 0.01
Pollutant Removed (H) = (F X G)		406.8
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed	\$21,479.17

**TABLE 5 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 1 of 2

Source	Control Device	Pollutant
Coal Combustion - Unit 1 ESP Outlet	Polishing Baghouse	PM10

### TOTAL CAPITAL COST FOR BAGHOUSE

DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$10,596,210
(b) Instrumentation (0.10 A)	(Included in 1A)
(c) Freight and Taxes (0.08 A)	\$847,697
Total Equipment Cost (B):	\$11,443,907

(2) Direct Installation Costs:	
(a) Foundations and Supports (0.04 B)	\$457,756
(b) Erection and Handling (1.4 B)	\$16,021,470
(c) Electrical (0.08 B)	\$915,513
(d) Piping (0.01 B)	\$114,439
(e) Heat Insulation (0.07 B)	\$801,073
(f) Painting (0.04 B)	\$457,756
(g) Demolition and Site Preparation (0.01 B)	\$114,439
Total Installation Cost (C)	\$18,882,446

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$30,326,353

INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.10 B)	\$1,144,391
(2) Construction and Field Expenses (0.20 B)	\$2,288,781
(3) Contractor Fees (0.10 B)	\$1,144,391
(4) Startup (0.01 B)	\$114,439
(5) Performance Test (0.01 B)	\$114,439
(6) Contingencies (0.03 B)	\$343,317
Total Indirect Costs of Capital Investment (ICCI)	\$5,149,758

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$35,476,111

ANNUALIZED COST OF CAPITAL INVESTMENT (BAGS)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	3.50
(3) Total Price of Full Set of Bags (including taxes, freight and labor) (TCB)	\$1,410,000
(3) Capital Recovery Factor (CRF)	0.332
(4) Capital Recovery Cost (BCRC) = (CRF X TCB)	\$468,100

ADJUSTED CAPITAL INVESTMENT (ATCI) = (TCI) - (TCB) \$34,066,111

ANNUALIZED COST OF CAPITAL INVESTMENT (ALL EQUIPMENT)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X ATCI)	\$3,215,600

**TABLE 5 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 2 of 2

Source	Control Device	Pollutant
Coal Combustion - Unit 1 ESP Outlet	Polishing Baghouse	PM10

**TOTAL ANNUAL O&M COST FOR BAGHOUSE**

**DIRECT COSTS (O&M):**

(1) Variable Costs

(a) Utilities

(a1) Electricity -

Cost: 0.0700 \$/kW  
Rate: 19,482,240 kW/yr

\$1,363,800

(b) Landfill Costs

(b1) Dust

Mass: 420 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$11,984

Total Direct Variable Costs (D)

\$1,375,784

(2) Semivariable Costs

(a) Labor

O = \$26.00

M = \$34.00

(a1) Operating (O) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$26/hr)

\$28,470

(a2) Supervisory (0.15 O)

\$4,300

(a3) Maintenance (M) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$34/hr)

\$37,230

(b) Maintenance Materials (M)

\$37,230

(c) Replacement Parts

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$572,200

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$114,400

(c3) Interest rate (i)

7%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.24

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$167,500

Total Semivariable Costs (E)

\$274,730

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$1,650,514

**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$42,000

(2) Property Tax (0.01 ATCI)

\$340,700

(3) Insurance (0.01 ATCI)

\$340,700

(4) Administration (0.02 ATCI)

\$681,300

Total Annual Indirect Costs of O&M (ICO&M)

\$1,404,700

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$3,055,214

**COST EFFECTIVENESS OF BAGHOUSE**

Capital Recovery Cost Of Bags (BCRC)	\$468,100	
Capital Recovery Cost of Equipment (CRC)	\$3,215,600	
Total Annual Costs of O&M (TAO&M)	\$3,055,214	
Total Annualized Cost (TAC) = (CRC + TAO&M)	\$6,738,914	
Control Device Loading Rate (F)	tons/yr 617.6	To Meet 0.012
Control Device efficiency (G)	68.1%	
Pollutant Removed (H) = (F X G)	420.5	
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed \$16,027	

**TABLE 6 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 1 of 2

Source	Control Device	Pollutant
Coal Combustion - Unit 2 ESP Outlet	Polishing Baghouse	PM10

### TOTAL CAPITAL COST FOR BAGHOUSE

DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$11,247,184
(b) Instrumentation (0.10 A)	(Included in 1A)
(c) Freight and Taxes (0.08 A)	\$899,775
Total Equipment Cost (B):	\$12,146,959

(2) Direct Installation Costs:	
(a) Foundations and Supports (0.04 B)	\$485,878
(b) Erection and Handling (1.4 B)	\$17,005,742
(c) Electrical (0.08 B)	\$971,757
(d) Piping (0.01 B)	\$121,470
(e) Heat Insulation (0.07 B)	\$850,287
(f) Painting (0.04 B)	\$485,878
(g) Demolition and Site Preparation (0.01 B)	\$121,470
Total Installation Cost (C)	\$20,042,482

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$32,189,441

INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.10 B)	\$1,214,696
(2) Construction and Field Expenses (0.20 B)	\$2,429,392
(3) Contractor Fees (0.10 B)	\$1,214,696
(4) Startup (0.01 B)	\$121,470
(5) Performance Test (0.01 B)	\$121,470
(6) Contingencies (0.03 B)	\$364,409
Total Indirect Costs of Capital Investment (ICCI)	\$5,466,131

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$37,655,572

ANNUALIZED COST OF CAPITAL INVESTMENT (BAGS)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	3.50
(3) Total Price of Full Set of Bags (including taxes, freight and labor) (TCB)	\$1,598,000
(3) Capital Recovery Factor (CRF)	0.332
(4) Capital Recovery Cost (BCRC) = (CRF X TCB)	\$530,500

ADJUSTED CAPITAL INVESTMENT (ATCI) = (TCI) - (TCB) \$36,057,572

ANNUALIZED COST OF CAPITAL INVESTMENT (ALL EQUIPMENT)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X ATCI)	\$3,403,600

**TABLE 6 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 2 of 2

Source	Control Device	Pollutant
Coal Combustion - Unit 2 ESP Outlet	Polishing Baghouse	PM10

**TOTAL ANNUAL O&M COST FOR BAGHOUSE**

**DIRECT COSTS (O&M):**

(1) Variable Costs

(a) Utilities

(a1) Electricity -

Cost: 0.0700 \$/kW  
Rate: 22,075,200 kW/yr

\$1,545,300

(b) Landfill Costs

(b1) Dust

Mass: 288 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$8,220

Total Direct Variable Costs (D)

\$1,553,520

(2) Semivariable Costs

(a) Labor

O = \$26.00

M = \$34.00

(a1) Operating (O) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$26/hr)

\$28,470

(a2) Supervisory (0.15 O)

\$4,300

(a3) Maintenance (M) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$34/hr)

\$37,230

(b) Maintenance Materials (M)

\$37,230

(c) Replacement Parts

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$607,300

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$121,500

(c3) Interest rate (i)

7%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.244

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$177,700

Total Semivariable Costs (E)

\$284,930

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$1,838,450

**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$42,000

(2) Property Tax (0.01 ATCI)

\$360,600

(3) Insurance (0.01 ATCI)

\$360,600

(4) Administration (0.02 ATCI)

\$721,200

Total Annual Indirect Costs of O&M (ICO&M)

\$1,484,400

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$3,322,850

**COST EFFECTIVENESS OF BAGHOUSE**

Capital Recovery Cost Of Bags (BCRC)	\$530,500
Capital Recovery Cost of Equipment (CRC)	\$3,403,600
Total Annual Costs of O&M (TAO&M)	\$3,322,850
Total Annualized Cost (TAC) = (CRC + TAO&M)	\$7,256,950
Control Device Loading Rate (F)	tons/yr 519.2
Control Device efficiency (G)	55.6%
Pollutant Removed (H) = (F X G)	288.4
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed \$25,161

To Meet 0.012



**TABLE 7 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 1 of 2

Source	Control Device	Pollutant
Unit 1 ESP - Convert to PTFE Baghouse	Converted ESP Baghouse	PM10

### TOTAL CAPITAL COST FOR BAGHOUSE

DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$18,408,294
(b) Instrumentation (0.10 A)	(Included in 1A)
(c) Freight and Taxes (0.08 A)	\$1,472,664
Total Equipment Cost (B):	\$19,880,958

(2) Direct Installation Costs:

(a) Foundations and Supports (0.04 B)	\$795,238
(b) Erection and Handling (in A above)	\$0
(c) Electrical (0.08 B)	\$1,590,477
(d) Piping (0.01 B)	\$198,810
(e) Heat Insulation (0.07 B)	\$1,391,667
(f) Painting (0.04 B)	\$795,238
(g) Demolition and Site Preparation (0.01 B)	\$198,810
Total Installation Cost (C)	\$4,970,239

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$24,851,197

INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.10 B)	\$1,988,096
(2) Construction and Field Expenses (0.20 B)	\$3,976,192
(3) Contractor Fees (0.10 B)	\$1,988,096
(4) Startup (0.01 B)	\$198,810
(5) Performance Test (0.01 B)	\$198,810
(6) Contingencies (0.03 B)	\$596,429
Total Indirect Costs of Capital Investment (ICCI)	\$8,946,431

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$33,797,628

ANNUALIZED COST OF CAPITAL INVESTMENT (BAGS)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	4.00
(3) Total Price of Full Set of Bags (including taxes, freight and labor) (TCB)	\$2,246,400
(3) Capital Recovery Factor (CRF)	0.295
(4) Capital Recovery Cost (BCRC) = (CRF X TCB)	\$663,200

ADJUSTED CAPITAL INVESTMENT (ATCI) = (TCI) - (TCB) \$31,551,228

ANNUALIZED COST OF CAPITAL INVESTMENT (ALL EQUIPMENT)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X ATCI)	\$2,978,200

**TABLE 7 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 2 of 2

Source	Control Device	Pollutant
Unit 1 ESP - Convert to PTFE Baghouse	Converted ESP Baghouse	PM10

**TOTAL ANNUAL O&M COST FOR BAGHOUSE**

**DIRECT COSTS (O&M):**

(1) Variable Costs

(a) Utilities

(a1) Electricity -	Cost: 0.0700 \$/kW	
	Rate: 19,482,240 kW/yr	\$1,363,800

(b) Landfill Costs

(b1) Dust	Mass: 519 ton/yr	
	Cost: 28.50 \$/ton (Estimate)	\$14,792

Total Direct Variable Costs (D)	\$1,378,592
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(2) Semivariable Costs

(a) Labor	O = \$26.00 M = \$34.00	
(a1) Operating (O) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$26/hr)		\$28,470
(a2) Supervisory (0.15 O)		\$4,300
(a3) Maintenance (M) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$34/hr)		\$37,230
(b) Maintenance Materials (M)		\$37,230
(c) Replacement Parts		
(c1) Initial cost of replacement parts (Cp) = (0.05 B)		\$994,000
(c2) Cost of parts replacement labor (Cpl) = (0.01 B)		\$198,800
(c3) Interest rate (i)		7%
(c4) Replacement parts Economic Life (n) (years)		5
(c5) Capital recovery factor of replacement parts (CRFp)		0.244
(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]		\$290,900

Total Semivariable Costs (E)	\$398,130
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Total Annual Direct Cost of O&M (DCO&M) = (D + E)	\$1,776,722
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**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)	\$42,000
(2) Property Tax (0.01 ATCI)	\$315,500
(3) Insurance (0.01 ATCI)	\$315,500
(4) Administration (0.02 ATCI)	\$631,000

Total Annual Indirect Costs of O&M (ICO&M)	\$1,304,000
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TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):	\$3,080,722
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**COST EFFECTIVENESS OF BAGHOUSE**

Capital Recovery Cost Of Bags (BCRC)	\$663,200	
Capital Recovery Cost of Equipment (CRC)	\$2,978,200	
Total Annual Costs of O&M (TAO&M)	\$3,080,722	
Total Annualized Cost (TAC) = (CRC + TAO&M)	\$6,722,122	
Control Device Loading Rate (F)	tons/yr	617.6
Control Device efficiency (G)		84.0%
Pollutant Removed (H) = (F X G)		519.0
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed	\$12,951

To Meet 0.006

**TABLE 8 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
**Progress Energy, Crystal River, Florida**

Page 1 of 2

Source	Control Device	Pollutant
Unit #2 ESP - Convert to Baghouse	Converted ESP Baghouse	PM10

### TOTAL CAPITAL COST FOR BAGHOUSE

DIRECT COSTS (capital investment)

(1) Purchased Equipment Costs:	
(a) Basic Equipment and Auxiliaries (A)	\$20,685,168
(b) Instrumentation (0.10 A)	(Included in 1A)
(c) Freight and Taxes (0.08 A)	\$1,654,813
Total Equipment Cost (B):	\$22,339,981

(2) Direct Installation Costs:	
(a) Foundations and Supports (0.04 B)	\$893,599
(b) Erection and Handling (in A above)	\$0
(c) Electrical (0.08 B)	\$1,787,198
(d) Piping (0.01 B)	\$223,400
(e) Heat Insulation (0.07 B)	\$1,563,799
(f) Painting (0.04 B)	\$893,599
(g) Demolition and Site Preparation (0.01 B)	\$223,400
Total Installation Cost (C)	\$5,584,995

Total Direct Costs of Capital Investment (DCCI) = (B + C) \$27,924,976

INDIRECT COSTS (capital investment):

(1) Engineering Costs (0.10 B)	\$2,233,998
(2) Construction and Field Expenses (0.20 B)	\$4,467,996
(3) Contractor Fees (0.10 B)	\$2,233,998
(4) Startup (0.01 B)	\$223,400
(5) Performance Test (0.01 B)	\$223,400
(6) Contingencies (0.03 B)	\$670,199
Total Indirect Costs of Capital Investment (ICCI)	\$10,052,991

TOTAL CAPITAL INVESTMENT (TCI) = (DCCI + ICCI): \$37,977,968

ANNUALIZED COST OF CAPITAL INVESTMENT (BAGS)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	4.00
(3) Total Price of Full Set of Bags (including taxes, freight and labor) (TCB)	\$2,545,920
(3) Capital Recovery Factor (CRF)	0.295
(4) Capital Recovery Cost (BCRC) = (CRF X TCB)	\$751,600

ADJUSTED CAPITAL INVESTMENT (ATCI) = (TCI) - (TCB) \$35,432,048

ANNUALIZED COST OF CAPITAL INVESTMENT (ALL EQUIPMENT)

(1) Interest Rate	7.0%
(2) Control System Economic Life (years)	20
(3) Capital Recovery Factor (CRF)	0.094
(4) Capital Recovery Cost (CRC) = (CRF X ATCI)	\$3,344,500

**TABLE 8 - BAGHOUSE COST DATA**  
**CONTROL EQUIPMENT ANALYSIS**  
Progress Energy, Crystal River, Florida

Page 2 of 2

Source	Control Device	Pollutant
Unit #2 ESP - Convert to Baghouse	Converted ESP Baghouse	PM10

**TOTAL ANNUAL O&M COST FOR BAGHOUSE**

**DIRECT COSTS (O&M):**

(1) Variable Costs

(a) Utilities

(a1) Electricity -

Cost: 0.0700 \$/kW  
Rate: 22,075,200 kW/yr

\$1,545,300

(b) Landfill Costs

(b1) Dust

Mass: 404 ton/yr  
Cost: 28.50 \$/ton (Estimate)

\$11,508

Total Direct Variable Costs (D)

\$1,556,808

(2) Semivariable Costs

(a) Labor

O = \$26.00

M = \$34.00

(a1) Operating (O) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$26/hr)

\$28,470

(a2) Supervisory (0.15 O)

\$4,300

(a3) Maintenance (M) = (1 hrs/shift X 3 shifts/day X day/24hrs X 8,760 hrs/yr X \$34/hr)

\$37,230

(b) Maintenance Materials (M)

\$37,230

(c) Replacement Parts

(c1) Initial cost of replacement parts (Cp) = (0.05 B)

\$1,117,000

(c2) Cost of parts replacement labor (Cpl) = (0.01 B)

\$223,400

(c3) Interest rate (i)

7%

(c4) Replacement parts Economic Life (n) (years)

5

(c5) Capital recovery factor of replacement parts (CRFp)

0.244

(c6) Capital Recovery Cost of replacement parts [(Cp+Cpl) X CRFp]

\$326,900

Total Semivariable Costs (E)

\$434,130

Total Annual Direct Cost of O&M (DCO&M) = (D + E)

\$1,990,938

**INDIRECT COSTS (O&M):**

(1) Overhead (60% of Sum of Operating, Supervisory, & Maintenance Labor)

\$42,000

(2) Property Tax (0.01 ATCI)

\$354,300

(3) Insurance (0.01 ATCI)

\$354,300

(4) Administration (0.02 ATCI)

\$708,600

Total Annual Indirect Costs of O&M (ICO&M)

\$1,459,200

TOTAL ANNUAL COSTS of O&M (TAO&M) = (DCO&M + ICO&M):

\$3,450,138

**COST EFFECTIVENESS OF BAGHOUSE**

Capital Recovery Cost Of Bags (BCRC)	\$751,600
Capital Recovery Cost of Equipment (CRC)	\$3,344,500
Total Annual Costs of O&M (TAO&M)	\$3,450,138
Total Annualized Cost (TAC) = (CRC + TAO&M)	\$7,546,238
Control Device Loading Rate (F)	tons/yr 519.2
Control Device efficiency (G)	77.8%
Pollutant Removed (H) = (F X G)	403.8
COST EFFECTIVENESS (TAC / H):	\$/ton of pollutant removed <b>\$18,688</b>

To Meet 0.006

## **ATTACHMENT 3**

### **Summary Tables of Revised Analysis Results**

**Table 3-1. Cost – Effectiveness (\$/ton) Summary Table\***

<b><i>Control Option Units 1 and 2</i></b>	<b><i>Original</i></b>		<b><i>Revised</i></b>	
	<b><i>Unit 1 (\$/ton)</i></b>	<b><i>Unit 2 (\$/ton)</i></b>	<b><i>Unit 1 Revised (\$/ton)</i></b>	<b><i>Unit 2 Revised (\$/ton)</i></b>
Baseline	N/A	N/A	N/A	N/A
0.015 lb/MMBtu ESP Upgrades	7,512	8,562	4,369	4,977
0.012 lb/MMBtu Polishing Baghouse	21,666	33,871	16,027	25,161
0.010 lb/MMBtu ESP Replacement	27,467	34,296	17,204	21,479
0.006 lb/MMBtu Baghouse Conversion	17,240	24,880	12,951	18,688

\* Revised costs assume a 7% interest rate and a 20 year equipment lifetime.

**Table 3-2. Cost-Effectiveness (\$/dV) Summary Table\***

<i>Control Option Units 1 and 2</i>	<i>Modeled dV Level</i>	<i>Units 1 and 2 Total Annualized Cost (\$)</i>	<i>Revised Units 1 and 2 Total Annualized Cost (\$)</i>	<i>\$/dV Reduced</i>	<i>Revised \$/dV Reduced</i>
Baseline	0.71	N/A	N/A	N/A	N/A
0.015 lb/MMBtu ESP Upgrades	0.61	4,696,661	2,730,761	46,966,610	27,307,610
0.012 lb/MMBtu Polishing Baghouse	0.60	18,879,064	13,995,864	171,627,855	127,235,127
0.010 lb/MMBtu ESP Replacement	0.58	26,380,791	16,522,791	202,929,162	127,098,392
0.006 lb/MMBtu Baghouse Conversion	0.56	18,994,460	14,268,360	126,629,733	95,122,400

\* Revised costs are based on a 7% interest rate and a 20 year equipment lifetime.