

Appendix A  
Cost Estimate and Basis

This appendix is included to show the detailed costs estimate and to describe the basis of the estimate. The estimate is based on previous studies and cost estimates for the addition of air pollution control equipment to Unit 1 at Nebraska City. A study was completed in 2002 that included obtaining estimates for equipment vendors in 2002. Due to current market conditions, equipment vendors are unwilling to provide quotes for studies. Other than a single estimate for SDA and fabric filter equipment, the cost estimate was based on escalating quotes received in 2002 and developing actual estimates for installation and support costs.

DETAILED COST SUMMARY, \$ US 2007	
	OPPD -NC1
I. SDA SYSTEM SITEWORK	750,000
II. DEMOLITION FOR SDA SYSTEM	150,000
III. BURNER MODIFICATIONS	17,400,000
IV. SCR EQUIPMENT	160,880,000
V. SDA - LIME PREPARATION EQUIPMENT AND BUILDING	10,500,000
VI. SDA/FF SYSTEM	103,120,000
VII. ID BOOSTER FAN EQUIPMENT	6,600,000
VIII. OUTAGE COST	22,930,000
IX. ASH HANDLING EQUIPMENT	1,000,000
X. AIR HEATERS	8,000,000
XI. ELECTRICAL MODIFICATIONS	2,860,000
SUBTOTAL CONSTRUCTION AND EQUIPMENT	334,190,000
CONTINGENCY (25%)	83,550,000
DESIGN/ENGINEERING/CM (10%)	41,770,000
TOTAL PER UNIT CAPITAL COST	459,510,000
ANNUAL AMORTIZED CAPITAL COST (See Note 1)	36,870,000
TOTAL STATION CAPITAL COST	459,510,000
ANNUAL AMORTIZED CAPITAL COST (See Note 1)	36,870,000

Item	Qty	Unit Price	Item Cost
<b>I. SDA SYSTEM SITEWORK (See Note 2)</b>			
Sitework	1	750,000	750,000
Earthwork			
General Earthwork			
Finishing Grading & Seeding			
Asphalt Roadways			
Site Utilities			
Fire Protection			
Water Supply			
Sewer System			
Electrical			
Site Drainage			
Fencing			
Landscaping			
Subtotal			750,000
<b>II. DEMOLITION FOR SDA SYSTEM</b>			
Demo Ductwork	1	150,000	150,000
Subtotal			150,000
<b>III. BURNER MODIFICATIONS</b>			
Low NOx Burner Upgrade	48	300,000	14,400,000
Over fire air Modifications	1	3,000,000	3,000,000
Subtotal			17,400,000
<b>IV. SCR EQUIPMENT</b>			
Equipment (See Note 3)			
SCR Equipment	1	70,000,000	70,000,000
Ash Handling Equipment Including Structural Steel	1	2,000,000	2,000,000
Equipment Installation			84,072,000
Erect SCR			
Install Air Heater			
Install Ammonia Storage and Delivery System			
Associated Mechanical			
Associated Electrical			
Cut over to operating unit			
Start-up and Shakedown			
Crane rental			
Foundations (See Note 4)			
Steel reinforced concrete, \$350/cy	60'x60'x96" 1,067	350	373,333
Ductwork			
Steel ductwork, 500lb/ft3, \$9/lb	300', 10'x20', 3/8" 281,250	9	2,531,250
Insulation, 25% of ductwork	1	632,813	632,813
Ductwork support/bracing, 25% of ductwork	1	1,265,625	1,265,625
Subtotal			160,880,000

<b>V. SDA - LIME PREPARATION EQUIPMENT AND BUILDING</b>			
Lime Equipment	1	5,000,000	5,000,000
Lime Storage Silo			
Feeders			
Slaker			
Grit screens			
Slurry Tank			
Slurry Pumps			
Dilution water tank			
Dilution Water Pumps			
Air Compressors			
Equipment Installation	1	3,000,000	3,000,000
Foundations			
Install Lime Preparation System (included in Lime System costs)			
Ductwork			
Associated Mechanical			
Associated Electrical			
Start-up and Shakedown			
Building	1	2,500,000	2,500,000
Structural Steel			
Concrete Slabwork			
Concrete Footings/Foundation			
Overhead Doors			
Building Fire Protection			
Mechanical			
Electrical			
Subtotal			10,500,000
<b>VI. SDA/FF SYSTEM</b>			
Equipment (See Note 5)			
Scrubber	1	23,000,000	23,000,000
Filter Baghouse	1	20,000,000	20,000,000
Ash Handling Equipment	1	500,000	500,000
Equipment Installation			43,761,600
Erect SDA			
Install Ash Handling System			
Associated Mechanical			
Associated Electrical			
Cut over to operating unit			
Start-up and Shakedown			
Crane rental			
Ductwork	1200', 10'x20', 3/8"		
Steel ductwork, 500lb/ft3, \$9/lb	1,125,000	9	10,125,000
Insulation, 25% of ductwork	1	2,531,250	2,531,250
Ductwork support/bracing, 25% of ductwork	1	2,531,250	2,531,250
Foundations	(2) 60'x60'x96", (2) 30'x30'x96"		
Steel reinforced concrete	2,667	250	666,667
Subtotal			103,120,000

VII. ID BOOSTER FAN EQUIPMENT ID Booster Fan (See Note 6)				6,600,000
Total				6,600,000
VIII. OUTAGE COST				
Electrical Outage Cost \$30/MW/hr	7 weeks			
MWhrs = #weeks * 168 hr/wk * MW capacity	764,400	30		22,932,000
Subtotal				22,930,000
IX. ASH HANDLING EQUIPMENT				
Ash Silo for SDA System	1	750,000		750,000
Ash Handling misc equipment for SDA System	1	250,000		250,000
Subtotal				1,000,000
X. AIR HEATERS				
For SCR System (See Note 7)	1	8,000,000		8,000,000
Subtotal				8,000,000
XI. ELECTRICAL MODIFICATIONS				
Cost = \$200/kW upgraded service				
New switchgear/transformers for increased electrical load - SDA System	8,032	200		1,610,000
New switchgear/transformers for Increased electrical load - SCR System	6,232	200		1,250,000
Subtotal				2,860,000
Subtotal I through X				334,190,000

Notes:

- (1) Interest rate 5% and amortization period 20 years
- (2) Allowance for relocation of utilities, roadways, and fencing as well as any general earthwork required.
- (3) Vendors were unwilling to provide quotes due to market conditions. Estimate was based on 2002 quotes for similar sized units, escalated to 2007 dollars and adjusted for capacity. Equipment cost is half of total installed cost. Escalation is approximately 68% over the time period.
- (4) Based on mat foundation under equipment footprint.
- (5) Based on Alstom quote for equipment.
- (6) ID fan sized for both SCR and SDA.
- (7) Cost to replace air heater baskets with baskets compatible with ammonia compounds.

<b>BURNER MODIFICATIONS CONCEPTUAL COST SUMMARY, 2007 \$</b>	
	<b>OPPD NC-1</b>
Technology NOx Control Unit Size, kW	Low NOx Burners, OFA 650,000
<b>Capital Costs</b>	
I. SDA SYSTEM SITEWORK	\$0
II. DEMOLITION FOR SDA SYSTEM	\$0
III. BURNER MODIFICATIONS	\$17,400,000
IV. SCR EQUIPMENT	\$0
V. SDA - LIME PREPARATION EQUIPMENT AND BUILDING	\$0
VI. SDA/FF SYSTEM	\$0
VII. ID BOOSTER FAN EQUIPMENT	\$0
VIII. OUTAGE COST	\$0
IX. ASH HANDLING EQUIPMENT	\$0
X. AIR HEATERS	\$0
XI. ELECTRICAL MODIFICATIONS	\$0
<u>SUBTOTAL CONSTRUCTION AND EQUIPMENT</u>	<u>\$17,400,000</u>
CONTINGENCY (10%)	\$1,740,000
DESIGN/ENGINEERING/CM (10%)	\$1,910,000
<b>TOTAL PER UNIT CAPITAL COST</b>	<b>\$21,050,000</b>
ANNUAL AMORTIZED CAPITAL COST (COST X CCRF)	\$1,690,000
<b>Operating Costs</b>	
I. LABOR	\$0
II. REAGENTS AND SUPPLIES	\$0
III. EQUIPMENT MAINTENANCE	\$0
IV. UTILITIES	\$0
V. ASH REVENUE AND/OR DISPOSAL COST	\$0
<u>SUBTOTAL OPERATION &amp; MAINTENANCE</u>	<u>\$0</u>
CONTINGENCY (25%)	\$0
<b>TOTAL PER UNIT ANNUAL OPERATION &amp; MAINTENANCE COST</b>	<b>\$0</b>
<b>TOTAL PER UNIT LEVELIZED ANNUAL O&amp;M COST (COST X OMLF)</b>	<b>\$0</b>
<b>TOTAL PER UNIT ANNUAL AMORITIZED CAPITAL AND LEVELIZED O&amp;M COST</b>	<b>\$1,690,000</b>

<b>SDA SCRUBBER &amp; FILTER BAGHOUSE CONCEPTUAL COST SUMMARY, 2007 \$</b>	
	<b>OPPD NC-1</b>
Technology SO2 Control Unit Size, kW	SDA & New Baghouse 650,000
<b>Capital Costs</b>	
I. SDA SYSTEM SITEWORK	\$750,000
II. DEMOLITION FOR SDA SYSTEM	\$150,000
III. BURNER MODIFICATIONS	\$0
IV. SCR EQUIPMENT	\$0
V. SDA - LIME PREPARATION EQUIPMENT AND BUILDING	\$10,500,000
VI. SDA/FF SYSTEM	\$103,120,000
VII. ID BOOSTER FAN EQUIPMENT	\$6,600,000
VIII. OUTAGE COST	\$22,930,000
IX. ASH HANDLING EQUIPMENT	\$1,000,000
X. AIR HEATERS	\$0
XI. ELECTRICAL MODIFICATIONS	\$1,610,000
<b>SUBTOTAL CONSTRUCTION AND EQUIPMENT</b>	<b>\$146,660,000</b>
CONTINGENCY (25%)	\$36,670,000
DESIGN/ENGINEERING/CM (10%)	\$18,330,000
<b>TOTAL PER UNIT CAPITAL COST</b>	<b>\$201,660,000</b>
ANNUAL AMORTIZED CAPITAL COST (COST X CCRF)	<b>\$16,180,000</b>
<b>Operating Costs</b>	
I. LABOR	\$420,000
II. REAGENTS AND SUPPLIES	\$3,310,000
III. EQUIPMENT MAINTENANCE	\$1,700,000
IV. UTILITIES	\$4,550,000
V. ASH REVENUE AND/OR DISPOSAL COST	\$510,000
<b>SUBTOTAL OPERATION &amp; MAINTENANCE</b>	<b>\$10,490,000</b>
CONTINGENCY (25%)	\$2,622,500
<b>TOTAL PER UNIT ANNUAL OPERATION &amp; MAINTENANCE COST</b>	<b>\$13,112,500</b>
<b>TOTAL PER UNIT LEVELIZED ANNUAL O&amp;M COST (COST X OMLF)</b>	<b>\$18,540,000</b>
<b>TOTAL PER UNIT ANNUAL AMORITIZED CAPITAL AND LEVELIZED O&amp;M COST</b>	<b>\$34,720,000</b>

<b>SCR NOX REMOVAL SYSTEM CONCEPTUAL COST SUMMARY, 2007 \$</b>	
	<b>OPPD NC-1</b>
Technology NOx Control Unit Size, kW	Low NOx Burners, SCR 650,000
<b>Capital Costs</b>	
I. SDA SYSTEM SITEWORK	\$0
II. DEMOLITION FOR SDA SYSTEM	\$0
III. BURNER MODIFICATIONS	\$0
IV. SCR EQUIPMENT	\$160,880,000
V. SDA - LIME PREPARATION EQUIPMENT AND BUILDING	\$0
VI. SDA/FF SYSTEM	\$0
VII. ID BOOSTER FAN EQUIPMENT	\$0
VIII. OUTAGE COST	\$22,930,000
IX. ASH HANDLING EQUIPMENT	\$0
X. AIR HEATERS	\$8,000,000
XI. ELECTRICAL MODIFICATIONS	\$1,250,000
<b>SUBTOTAL CONSTRUCTION AND EQUIPMENT</b>	<b>\$193,060,000</b>
CONTINGENCY (25%)	\$48,265,000
DESIGN/ENGINEERING/CM (10%)	\$24,130,000
<b>TOTAL PER UNIT CAPITAL COST</b>	<b>\$265,455,000</b>
ANNUAL AMORTIZED CAPITAL COST (COST X CCRF)	<b>\$21,300,000</b>
<b>Operating Costs</b>	
I. LABOR	\$210,000
II. REAGENTS AND SUPPLIES	\$2,400,000
III. EQUIPMENT MAINTENANCE	\$2,410,000
IV. UTILITIES	\$4,550,000
V. ASH REVENUE AND/OR DISPOSAL COST	\$0
<b>SUBTOTAL OPERATION &amp; MAINTENANCE</b>	<b>\$9,570,000</b>
CONTINGENCY (25%)	\$2,390,000
<b>TOTAL PER UNIT ANNUAL OPERATION &amp; MAINTENANCE COST</b>	<b>\$11,960,000</b>
<b>TOTAL PER UNIT LEVELIZED ANNUAL O&amp;M COST (COST X OMLF)</b>	<b>\$16,910,000</b>
<b>TOTAL PER UNIT ANNUAL AMORITIZED CAPITAL AND LEVELIZED O&amp;M COST</b>	<b>\$38,210,000</b>

SDA SYSTEM OPERATING COST, \$ US 2007				
	NC1			
I. LABOR				416,000
II. REAGENTS AND SUPPLIES				3,306,000
III. EQUIPMENT MAINTENANCE				1,704,000
IV. UTILITIES				4,550,000
V. ASH REVENUE AND/OR DISPOSAL COST				509,000
SUBTOTAL OPERATION & MAINTENANCE				10,485,000
CONTINGENCY (25%)				2,621,000
TOTAL PER UNIT ANNUAL OPERATION & MAINTENANCE COST				13,106,000
TOTAL STATION ANNUAL OPERATION & MAINTENANCE COST				13,106,000
Unit Annual Operating Hours				7,884
Item	Qty	Units	Unit Price	Item Cost

I. LABOR				
Operators	4			
Equipment Operator	8,320	hr	50.00	416,000
Subtotal				416,000
Notes:				
II. REAGENTS AND SUPPLIES				
Lime	23,569	Tons	125	2,946,000
Ammonia	0	Tons	0	0
SDA Filter Replacement (18,000 bags, \$100/bag, once per 5 years)	0.20	LS	1,800,000	360,000
SCR Catalyst Replacement	0	LS	0	0
Subtotal				3,306,000
Notes:				
SCR catalyst replacement is based on 0.28 mils/kWh.				
III. EQUIPMENT MAINTENANCE				
(1.5% of cost)	1		1,704,300	1,704,300
Subtotal				1,704,000
IV. UTILITIES				
Electricity	51,494,862	kWh	0.03	1,545,000
Electrical Capacity	6,532	kW	460	3,005,000
Subtotal				4,550,000
Notes:				
V. ASH REVENUE AND/OR DISPOSAL COST				
Saleable Ash		Tons		0
Additional ash requiring disposal (previously saleable ash) + lost revenue	0	Tons	12	0
Additional ash requiring disposal (2.4 lbs CaSO4 per lb CaO)	56,566	Tons	9	509,000
Subtotal				509,000
Subtotal I through V				10,485,000

<b>SCR SYSTEM OPERATING COST, \$ US 2007</b>	
	<b>NC1</b>
I. LABOR	208,000
II. REAGENTS AND SUPPLIES	2,400,000
III. EQUIPMENT MAINTENANCE	2,413,000
IV. UTILITIES	4,550,000
V. ASH REVENUE AND/OR DISPOSAL COST	0
SUBTOTAL OPERATION & MAINTENANCE	9,571,000
CONTINGENCY (25%)	2,393,000
TOTAL PER UNIT ANNUAL OPERATION & MAINTENANCE COST	11,964,000
TOTAL STATION ANNUAL OPERATION & MAINTENANCE COST	11,964,000
Unit Annual Operating Hours	7,884

Item	Qty	Units	Unit Price	Item Cost
<b>I. LABOR</b>				
Operators	2			
Equipment Operator (1),(2)	4,160	hr	50.00	208,000
Subtotal				208,000
Notes:				
<b>II. REAGENTS AND SUPPLIES</b>				
Lime		0 Tons	0	0
Ammonia	3,217	Tons	300	965,000
SDA Filter Replacement (18,000 bags, \$100/bag, once per 5 years)		0 LS		0
SCR Catalyst Replacement		1 LS	1,434,888	1,435,000
Subtotal				2,400,000
SCR catalyst replacement is based on 0.28 mils/kWh.				
<b>III. EQUIPMENT MAINTENANCE</b>				
(1.5% of cost)		1	2,413,200	2,413,200
Subtotal				2,413,000
<b>IV. UTILITIES</b>				
Electricity	51,494,862	kWh	0.03	1,545,000
Electrical Capacity	6,532	kW	460	3,005,000
Subtotal				4,550,000
Notes:				
<b>V. ASH REVENUE AND/OR DISPOSAL COST</b>				
Saleable Ash		Tons		0
Additional ash requiring disposal (previously saleable ash) + lost revenue		0 Tons	12	0
Additional ash requiring disposal (2.4 lbs CaSO4 per lb CaO)		0 Tons	9	0
Subtotal				0
Subtotal I through V				9,571,000

	NCS 1
<b>Unit(s) Size, kW</b>	<b>650,000</b>
Unit(s) Heat, Btu/kWh	9,790
Flue Gas Flow, acfm	2,665,000
Additional SCR, SDA, BH and Ductwork ΔP, inwg	23.3
Lime Usage	
Lime Usage, lb/hr	5,979
<b>Annual Lime Usage, tpy (1)</b>	<b>23,569</b>
Ammonia Usage	
Ammonia Usage, lb/hr	816
<b>Annual NH4 Usage, tpy (1)</b>	<b>3,217</b>
Water Usage	
Slaker Water, lb/hr	18,187
Dilution Water, lb/hr	239,556
Total Water Usage, lb/hr	257,743
Total Water Usage, gpm	515
<b>Total Annual Water Usage, kgpy (1)</b>	<b>243,845</b>
Power Usage	
Atomizer demand, kW	740
ID booster fans demand, kW	12,183
SCR motors demand, kW	140
SDA motors demand, kW	1,200
Total demand, kW	13,063
<b>Annual power usage, kWh/yr (1)</b>	<b>102,989,723</b>
<b>Parasitic Power, % of net</b>	<b>2.01%</b>

Notes:

(1) Annual utility usage based on 8760 hr/yr and 90% unit capacity factor