CI 28867

LIN – Unit #1 Low Nox Combustion Firing System

July 30, 2010

NOVA SCOTIA POWER
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UARB APPROVAL SHEET

Project Title: **LIN-Unit #1 Low Nox Combustion Firing System**

CI Number: 28867

☐ Capital Project Authorization

☐ ATO

■ Final Cost

Head Office Use:

Project Number: S266

Date: July 30, 2010

Location:

Division:

Expenditure Profile

YEAR	Budget Estimate	Project Estimate
2007		25,271
2008	4,149,920	3,727,331
2009		122,771
Total	$4,149,920	$3,875,373

Schedule

Start Date	2007-10
In-Service Date	2009-01
Close Date	2009-10

COMMENTS

Approved Amount	4,149,920
Actual Spending	3,875,373
Variance	($274,547)

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

M Savory July 24/2010

Authorized Signatory DATE
Mark Savory
VP Technical and Construction

Approved on behalf of NOVA SCOTIA UTILITY AND REVIEW BOARD

DATE

CI Number :	28867-S266	- LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM	Project Number	S266
Parent CI Number :		-		
Cost Centre :	304	- 304-Lingan 1&2 Prod. Unit	Budget Version -	2010 06/06 Forecast

	Forecast
Start :	10/01/2007
Operational :	01/30/2009
Final Cost :	10/30/2009
2007	$25,271.10
2008	$3,727,331.29
2009	$122,770.58
Total :	$3,875,372.97
Original Cost :	$0.00

The purpose of this project is to install a low NOx combustion firing system on Lingan Unit 1.

The scope of the work includes:

-Pre-outage baseline performance testing;
-Installation of low NOx combustion firing system, including an overfire air system, burner and windbox modifications and associated control equipment and instrumentation;
-Adjustment and tuning of existing burner automation and boiler modulating systems;
-Installation of waterwall offset corner tube panel assemblies for the new overfire air port openings in the furnace waterwalls;
-Modification of platforms, stairs, grating, and structural steel required for access to the equipment;
-Installation of Continuous Emission Monitors for NOx and carbon monoxide;
-Staff training on the new equipment;
-Calibration and testing of field equipment and instrumentation;
-Commissioning and tuning of the Low NOx Combustion Firing System; and
-Post-outage performance testing of the Low NOx Combustion Firing System.

CI Number : 28867-S266 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM **Project Number** S266

Parent CI Number : - **Approved Date** 11/8/2007

Cost Centre : 304 - 304-Lingan 1&2 Prod. Unit **Budget Version** 2010 06/06 Forecast

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
001		001 - Regular Labour (No AO)		23,039	0	23,039
001		001 - THERMAL Regular Labour		26,355	0	26,355
002		002 - Overtime Labour (No AO)		2,582	0	2,582
011		011 - Travel Expense		25,029	0	25,029
012		012 - Materials		83,527	0	83,527
028		028 - Consulting		48,788	0	48,788
041		041 - Meals & Entertainment		2,568	0	2,568
042		042 - Employee Benefits		1,029	0	1,029
092		092-Vehicle T&D Reg. Labour AO		533	0	533
092		092-Vehicle T&D OT Labour AO		546	0	546
094		094 - Interest Capitalized		116,637	0	116,637
095		095-COPS Regular Labour AO		1,024	0	1,024
095		095-Thermal Term Labour AO		910	0	910
095		095-COPS Overtime Labour AO		1,048	0	1,048
095		095-Thermal & Hydro Contracts AO		116,396	0	116,396
095		095-COPS Contracts AO		(531)	0	(531)
095		095 - Admin. Overheads		1,462	0	1,462
095		095-Thermal Overtime Labour AO		4,372	0	4,372
095		095-Thermal Regular Labour AO		19,289	0	19,289
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	89,240	0	89,240
001	013	001 - T&D Regular Labour	013 - SGP - Boiler	1,067	0	1,067
001	013	001 - Regular Labour (No AO)	013 - SGP - Boiler	14,000	0	14,000
002	013	002 - T&D Overtime Labour	013 - SGP - Boiler	2,184	0	2,184
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	51,438	0	51,438
002	013	002 - Overtime Labour (No AO)	013 - SGP - Boiler	2,217	0	2,217
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	5,352	0	5,352
004	013	004 - Term Labour (NO AO)	013 - SGP - Boiler	7	0	7
011	013	011 - Travel Expense	013 - SGP - Boiler	2,116	0	2,116
012	013	012 - Materials	013 - SGP - Boiler	699,557	0	699,557
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	2,532,493	0	2,532,493
014	013	014 - Overtime Meals	013 - SGP - Boiler	73	0	73
041	013	041 - Meals & Entertainment	013 - SGP - Boiler	658	0	658

CI Number : 28867-S266 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM **Project Number** S266

Parent CI Number : - **Approved Date** 11/8/2007

Cost Centre : 304 - 304-Lingan 1&2 Prod. Unit **Budget Version** 2010 06/06 Forecast

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
042	013	042 - Employee Benefits	013 - SGP - Boiler	367	0	367
			Total Cost:	3,875,373	0	3,875,373
			Original Cost:			

CI Number	: 28867-S266	- LIN UNIT#1 LOW NOX COMBUSTION FIRIN	**Project Number**	S266
Parent CI Number	:	-	**Approved Date**	11/8/2007
Cost Centre	: 304	- 304-Lingan 1&2 Prod. Unit		

Capital Item Justification

Justification Criteria : ENVIRONMENT
Sub-Criteria :
Name of Report :
Document Location :
Person Responsible :

Why do this project?

As specified in Schedule C of the Air Quality Regulations (N.S. Reg. 28/2005), NSPI has a regulatory requirement to limit annual NOx emissions to 21,365 tonnes starting in 2009. Installation of Low NOx Combustion Firing Systems on NSPI solid fuel generating units is the lowest cost option that will achieve the required NOx reduction.

The installation of a Low NOx Combustion Firing systems on Lingan Unit 1 is part of the third year of projects of a four year program. Three prior LNCFS installations have been approved by the UARB and are nearing completion. Performance achieved to date has reinforced the original NOx reductions forecast for this program.

Why do this project now?

The project planned for 2008 on Lingan Unit 1 is required for NSPI to comply with provincial regulations in 2009. Continuing the NOx reduction program in 2008 allows NSPI to align this installation with planned maintenance outages and assess the performance of completed retrofits to determine whether further investment in this program is required and refine processes as appropriate.

Why do this project this way?

Low NOx Combustion Firing Systems incorporating low NOx burners and separated overfire air systems have been evaluated as the least cost technology capable of meeting the legislated NOx reduction, effective 2009. The installed LNCFS on Lingan Unit 3 is approaching one year of service and the performance has been consistent with expected NOx reduction levels. The results on Unit 3 confirm the NOx reduction approach taken is capable of meeting the required NOx reduction.

CI Number	: 28867-S266	- LIN UNIT#1 LOW NOX COMBUSTION FIRIN	**Project Number**	S266
Parent CI Number	:	-	**Approved Date**	11/8/2007
Cost Centre	: 304	- 304-Lingan 1&2 Prod. Unit		

Reason for Variance / Over Expenditure / Final Costing

13604898

Please see the detailed variance explanation sheet.

Lingan Unit #1- Low Nox Combustion Firing System				
Low Nox Combustion Firing System				
CI #28867-S266				
Account	**Activated**	**Actual**	**Variance**	**Explain Variance**
001 - THERMAL Regular Labour	$295,000	$153,701	($141,299)	Less plant trades and engineering resources required than initially estimated.
002 - THERMAL Overtime Labour	$20,000	$58,421	$38,421	Other required work took place during the maintenance outage, causing additional overtime to be required.
004 - THERMAL Term Labour	$20,000	$5,359	($14,641)	Less term employees were used than initially estimated.
011 - Travel Expense	$18,000	$27,145	$9,145	More travel for due diligence activites was completed because this was a new supplier to NSPI.
012 - Materials	$1,712,300	$783,084	($929,216)	The ratio of installation (contracts) versus supply (materials) was incorrect in the original estimate.
013 - Contracts	$1,725,000	$2,532,493	$807,493	The ratio of installation (contracts) versus supply (materials) was incorrect in the original estimate.
014 - Overtime Meals	$0	$73	$73	
028 - Consulting	$115,000	$48,788	($66,212)	Consultant savings due to less consulting service used and testing work completed by NSP resources.
041 - Meals & Entertainment	$6,000	$3,226	($2,774)	
042 - Employee Benefits	$0	$1,396	$1,396	
094 - Interest	$104,000	$116,637	$12,637	
095 - Admin. Overheads	$134,620	$145,049	$10,429	Increase in AO is due to contracts increasing and this is offset by labour decreasing.
	$4,149,920	$3,875,372	($274,548)	

NOVA SCOTIA POWER
An Emera Company

UARB APPROVAL SHEET

Project Title: **LIN Unit #1 Low Nox Combustion Firing System**

CI Number: 28867

- [x] Capital Project Authorization
- [ ] ATO
- [ ] Final Cost

Head Office Use:

Project Number: S2606

Date: September 21, 2007

Location:

Division:

Expenditure Profile

YEAR	Budget Estimate	Project Estimate
2008	4,149,920	4,149,920
Total	$4,149,920	$4,149,920

Schedule

Estimated Start Date	2007-10
Estimated In-Service Date	2008-10
Estimated Close Date	2008-12

COMMENTS

If U&U Note: This item is submitted pursuant to section 35A (3)

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

Authorized Signatory
William Hattie
VP Generation Planning & Infrastructure
DATE Sept 22/07

Approved on behalf of NOVA SCOTIA UTILITY AND REVIEW BOARD

Margaret A.M. Shears 31/10/07

Margaret A.M. Shears
Vice-Chair
DATE

NSPI
CMS7155

Capital Management System
Capital Item Detail
Forecast

Date: 2007/09/24
Page: 1 of 4

CI Number: 28867 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM
Parent CI Number: -
Responsibility: 05270000 - GENERATION SERVICES
Cost Centre: 304 - Lingan 1&2 Prod. Unit

Project Number:
Parent Project Number:
Activated ACE Year:
Current ACE Year: 2008

Capital Item Summary

Created by/on: AF339 2007/07/27
Last Updated by/on: AD738 2007/09/24
Recommended by/on:
Activated by/on:
Operational by/on:
Ato Recommended by/on:
Ato Granted by/on:
Final Costed by/on:

	Forecast	
Start:	2007/10	
Operational:	2008/10	
Final Cost:	2008/12	
2008	4,149,920	0
Capital Contribution:	0	0
Total:	4,149,920	0
Original Cost:	0	0

Routine/Special: Special
Interest Type: Cumulative
Integrated Resource: No
PCR Controlled: No

The purpose of this project is to install a low NOx combustion firing system on Lingan Unit 1.

The scope of the work includes:

- Pre-outage baseline performance testing;
- Installation of low NOx combustion firing system, including an overfire air system, burner and windbox modifications and associated control equipment and instrumentation;
- Adjustment and tuning of existing burner automation and boiler modulating systems;
- Installation of waterwall offset corner tube panel assemblies for the new overfire air port openings in the furnace waterwalls;
- Modification of platforms, stairs, grating, and structural steel required for access to the equipment;
- Installation of Continuous Emission Monitors for NOx and carbon monoxide;
- Staff training on the new equipment;
- Calibration and testing of field equipment and instrumentation;
- Commissioning and tuning of the Low NOx Combustion Firing System; and
- Post-outage performance testing of the Low NOx Combustion Firing System.

NSPI
CMS7155

Capital Management System
Capital Item Detail
Forecast

Date: 2007/09/24
Page: 2 of 4

CI Number: 28867 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM
Parent CI Number: -
Responsibility: 05270000 - GENERATION SERVICES
Cost Centre: 304 - Lingan 1&2 Prod. Unit

Project Number:
Parent Project Number:
Activated ACE Year:
Current ACE Year: 2008

Capital Item Accounts

Acct	Actv	Div	Account	Activity	Forecast Amount	Amount	Variance
094	005	0527	INTEREST CAPITALIZED	005 Indirect Costs	104,000	0	0
095	005	0527	CONSTRUCTION OVERHEAD	005 Indirect Costs	134,620	0	0
001	013	0527	REGULAR LABOUR	013 Boiler	130,000	0	0
002	013	0527	OVERTIME LABOUR	013 Boiler	20,000	0	0
004	013	0527	TERM LABOUR	013 Boiler	20,000	0	0
011	013	0527	TRAVEL	013 Boiler	3,000	0	0
012	013	0527	MATERIALS	013 Boiler	1,710,800	0	0
013	013	0527	CONTRACTS	013 Boiler	1,725,000	0	0
041	013	0527	MEALS AND ENTERTAINMENT	013 Boiler	1,000	0	0
001	085	0527	REGULAR LABOUR	085 Design	165,000	0	0
011	085	0527	TRAVEL	085 Design	15,000	0	0
012	085	0527	MATERIALS	085 Design	1,500	0	0
028	085	0527	CONSULTING	085 Design	115,000	0	0
0	085	0527	MEALS AND ENTERTAINMENT	085 Design	5,000	0	0
066	BGT	0527	OTHER GOODS & SERVICES	BGT Budget Only Capital Act:	0	0	0
				Total Cost:	4,149,920	0	0

CI Number: 28867 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM
Parent CI Number: -
Responsibility: 05270000 - GENERATION SERVICES
Cost Centre: 304 - Lingan 1&2 Prod. Unit

Project Number:
Parent Project Number:
Activated ACE Year:
Current ACE Year: 2008

Capital Item Justification

Justification Criteria: ENVIRONMENT
Sub-Criteria:
Name Of Report:
Document Location:
Person Responsible: DEBRA MCLELLAN

Created by/on: AD738 2007/08/08
Updated by/on: AD738 2007/09/20

Justification Memo: 1. Why Do This Project?

As specified in Schedule C of the Air Quality Regulations (N.S. Reg. 28/2005), NSPI has a regulatory requirement to limit annual NOx emissions to 21,365 tonnes starting in 2009. Installation of Low NOx Combustion Firing Systems on NSPI solid fuel generating units is the lowest cost option that will achieve the required NOx reduction.

The installation of a Low NOx Combustion Firing systems on Lingan Unit 1 is part of the third year of projects of a four year program. Three prior LNCFS installations have been approved by the UARB and are nearing completion. Performance achieved to date has reinforced the original NOx reductions forecast for this program.

2. Why Do This Project Now?

The project planned for 2008 on Lingan Unit 1 is required for NSPI to comply with provincial regulations in 2009. Continuing the NOx reduction program in 2008 allows NSPI to align this installation with planned maintenance outages and assess the performance of completed retrofits to determine whether further investment in this program is required and refine processes as appropriate.

3. Why Do the Project This Way?

Low NOx Combustion Firing Systems incorporating low NOx burners and separated overfire air systems have been evaluated as the least cost technology capable of meeting the legislated NOx reduction, effective 2009. The installed LNCFS on Lingan Unit 3 is approaching one year of service and the performance has been consistent with expected NOx reduction levels. The results on Unit 3 confirm the NOx reduction approach taken is capable of meeting the required NOx reduction.

NSPI
CMS7155

Capital Management System
Capital Item Detail
Forecast

Date: 2007/09/24
Page: 4 of 4

CI Number: 28867 - LIN UNIT#1 LOW NOX COMBUSTION FIRING SYSTEM
Parent CI Number: -
Responsibility: 05270000 - GENERATION SERVICES
Cost Centre: 304 - Lingan 1&2 Prod. Unit

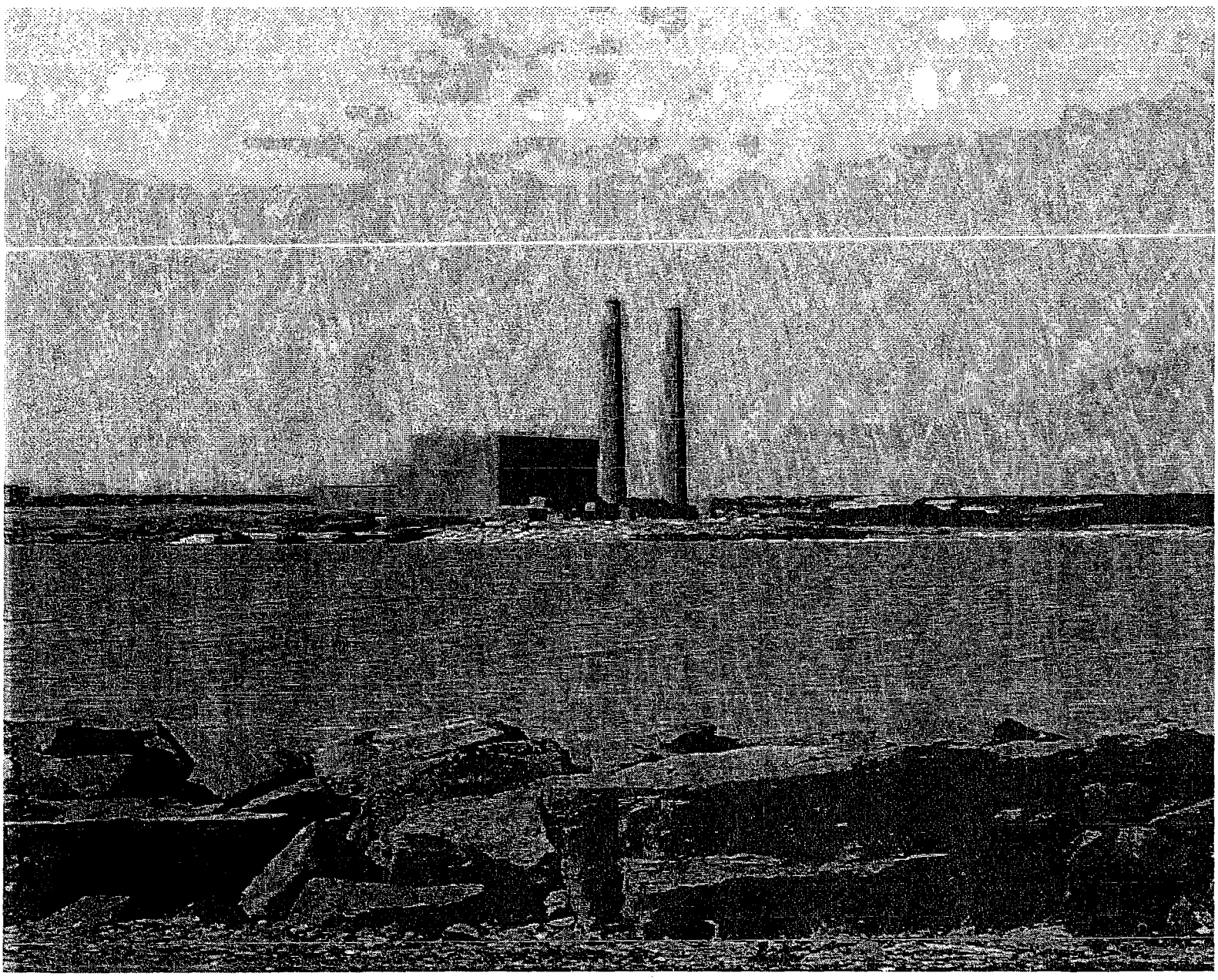
Project Number:
Parent Project Number:
Activated ACE Year:
Current ACE Year: 2008

Reason for Variance / Over Expenditure / Final Costing

Created by/on:
Updated by/on:

ORIGINAL

LOW NO_x COMBUSTION FIRING SYSTEMS
LINGAN 1 (CI 28867), Pt. Tupper 2 (CI 28865) and Trenton 6 (CI 28866)



NOVA SCOTIA POWER
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2008 NO_x REDUCTION PROGRAM

RECEIVED
SEP 25 2007
Nova Scotia
Utility and Review Board

September 2007

Table of Contents

APPENDICES

I. Air Quality Regulations (N.S. Reg. 28/2005), Schedule C

II. Project Cost Estimates

III. CMS Documentation

Background

By 2009, Nova Scotia Power Inc. (NSPI) nitrogen oxides (NO_x) emissions must be reduced to 20% below Year 2000 levels. This is required by an amendment to the Nova Scotia *Environment Act* (S.N.S. 1994-1995, c.1) (see Appendix I).

The Year 2000-based reduction is in addition to that necessary to offset the increase in annual NO_x production since 2000. The increase since 2000 is due to increased thermal generation and changes in fuel blends since that time (see figure below). 2006 reflects a major customer not operating.

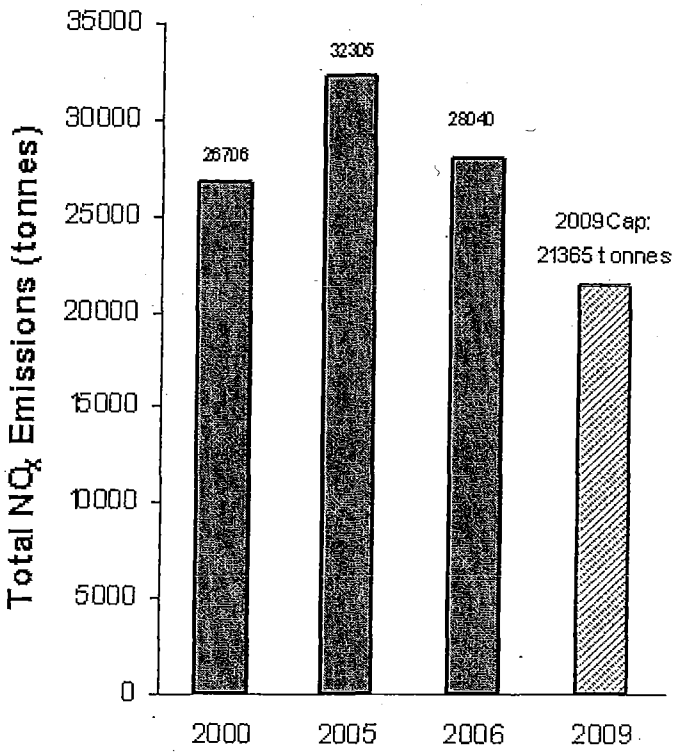

Figure 1 NSPI Annual NO_x Emissions and 2009 Cap

In 2005, NSPI developed a NO_x reduction program to ensure compliance with the Province's Regulations. The program calls for the installation of Low NO_x Combustion Firing Systems (LNCFS) on seven of NSPI's eight solid fuel generation units. The program includes Lingan Units 1-4, Point Tupper 2 and Trenton Units 5 and 6. Point Aconi was not included in the program because it was constructed with NO_x reduction technology.

As the first step in this program, in 2005 NSPI filed a work order application with the Nova Scotia Utility and Review Board (UARB, the Board) requesting approval to install a Low NO_x Combustion Firing System (LNCFS) on Lingan Unit 3. The Lingan Unit 3 work order was approved by the UARB in 2006, with the direction that NSPI undertake a program of combustion optimization and complete an assessment of the Lingan Unit 3 LNCFS installation, prior to additional applications under this program.

The Lingan Unit 3 retrofit was completed in 2006. NSPI also complied with the Board's directives concerning the combustion optimization and Lingan 3 assessment. This information was filed with the Board. As well the results were incorporated within the applications filed with the Board in 2006 to complete additional LNCFS retrofits on Lingan Units 2 and 4 in 2007. These projects were approved by the Board in 2007. The two retrofits, the second and third in the NO_x reduction program, are to be completed in the fall of 2007.

The enclosed provides for the execution of Year 3 of the Low NO_x program. LNCFS installations are proposed for 2008 for Lingan Unit 1, Point Tupper Unit 2 and Trenton Unit 6.

NO_x Reduction Multi-Year Plan

The table below summarizes NSPI's NO_x Reduction Program. The program incorporates low NO_x combustion technology, combined with associated combustion optimization to enable NSPI to meet its NO_x cap in 2009. Annual LNCFS installations are presented for the years 2005 to 2009, along with the forecast reduction for 2009, and gap from that required by Nova Scotia Regulations.

The Program has not changed materially from that presented in the previous applications to the UARB. NSPI continues to forecast that installations for six solid fuel fired units are required to meet the 2009 target by a small margin. A decision with respect to the requirement for a subsequent 2009 installation will be made in 2008.

Table 1 Multi Year NO_x Reduction Program

Emission Point	2009 Forecast[1]				
	2005 No Retrofits	2006 Program (Lingan 3)	2007 Program (Lingan 2 &4)	2008 Program (Lingan 1 Trenton 6 Pt. Tupper 2)	2009 Program (Trenton5)
Lingan 1	3705	3705	3705	**1720**	1720
Lingan 2	3769	3769	**1749**	1749	1749
Lingan 3	4135	**1725**	1725	1725	1725
Lingan 4	4185	4185	**1745**	1745	1745
Point Tupper	3559	3559	3559	**1761**	1761
Trenton 5	4266	4266	4266	4266	**3631**[2]
Trenton 6	4421	4421	4421	**2010**	2010
Other NSPI[3]	5522	5522	5522	5522	5522
NOx Emissions (tonnes)	33561	31151	26691	20497	19862
Delta from 2009 cap (21365 t)	12196	9786	5326	-868	-1503
% reduction from 2000	-	-	0.1%	**23.2%**	**25.6%**

Summaries of the annual programs are provided below:

2006 – Lingan Unit 3 – The 2006 work scope included the installation of a Low NO_x Combustion Firing System on Lingan Unit 3 and a program of combustion optimization. This project is to be final-costed in 2007. The current estimate is $3.8 million. Unit 3 has maintained good performance since commissioning, with NO_x emissions intensity reduction of greater than 50%.

[1] Each of the columns projects 2009 NO_x emissions that will result from the completion of that year's NO_x reduction retrofits.
[2] Based on September 2009 maintenance outage.
[3] Includes emissions from Point Aconi, Tufts Cove, and Combustion Turbines.

2007 - Lingan Units 2 and 4 - The 2007 work scope includes the installation of Low NO_x Combustion Firing Systems on Lingan Units 2 and 4. The work is to be completed in the fall of 2007.

Current estimates for the cost of the retrofits for Lingan Units 2 and 4 are $4.1 million and $4.4 million respectively. Combustion optimization and tuning is being completed for the new equipment. Completion of these projects will enable NO_x emissions to be reduced to approximately the levels produced by NSPI in 2000.

2008 - Lingan Unit 1, Point Tupper Unit 2 and Trenton Unit 6 - The 2008 work scope includes the installation of Low NO_x Combustion Firing Systems on Lingan Unit 1, Point Tupper Unit 2 and Trenton Unit 6. Combustion optimization and tuning of the new equipment will be included.

This work scope is forecast to provide a nominal reduction of 868 tonnes below the 2009 NOx emissions cap, providing a small margin to accommodate changes in operating conditions resulting from fuels and seasonal variation.

2009 - Trenton Unit 5 - The current 2009 work scope includes the installation of a Low NO_x Combustion Firing System on Trenton Unit 5. Combustion optimization and tuning of the new equipment will be included. This project will be considered in 2008 and a work order application for Unit 5 will be prepared and submitted to the UARB at that time if appropriate.

The forecast NO_x reduction from this unit in 2009 to 3,631 tonnes assumes installation of LNCFS equipment in September, 2009.

Summary

NSPI will shortly complete Year 2 of the four-year NO_x Reduction Program. Within the coming weeks the third retrofit will be completed. This will leave three units to be retrofitted, in 2008 and, it's expected, one unit to be completed in 2009. NSPI's evaluation to date confirms the NO_x reductions originally forecast for the retrofitted units are being achieved.

NSPI's four year plan is unchanged from previous work order filings. To meet the requirement for a total reduction of 20% below 2000 levels, Low NO_x Combustion Firing System retrofits for Lingan 1, Trenton 6 and Point Tupper 2 will be required in 2008. This work is forecast to provide the required system-wide NO_x reduction by a small margin. A determination as to whether additional investment in this program will be necessary is planned for 2008.

Work Order Requests

Pending UARB approval, in 2008 NSPI will undertake the third year of its four year NO_x Reduction program. Three low NO_x retrofits are required for Lingan Unit 1 (CI 28867), Point Tupper Unit 2 (CI 28865), and Trenton Unit 6 (CI 28866) at an estimated cost of $4.1 million, $4.5 million, and $5.6 million respectively.

Project budget estimates have been prepared based on costs provided by the Original Equipment Manufacturers and actual costs incurred during the low NO_x retrofit projects on Lingan Units 2, 3, and 4.

The Lingan 3 project is estimated at $3.8 million. The approved cost for Lingan 2 is $4.1 million and $4.4 million for Lingan 4. The higher estimate provided in the Trenton 6 application is due to the boiler construction and burner design for this unit which will require more extensive modifications than prior LNCFS installations. Market prices for materials and labour is also generally affecting the costs of these projects.

Cost detail and Capital Management System documentation for the three projects is provided in Appendices II and III respectively.

The scope of the work includes:

- Pre-outage baseline performance testing;
- Installation of low NO_x combustion firing system, including an overfire air system, burner and windbox modifications and associated control equipment and instrumentation;
- Adjustment and tuning of existing burner automation and boiler modulating systems;

- Installation of waterwall offset corner tube panel assemblies for the new overfire air port openings in the furnace waterwalls;
- Modification of platforms, stairs, grating, and structural steel required for access to the equipment;
- Installation of Continuous Emission Monitors for NO_x and carbon monoxide;
- Staff training on the new equipment;
- Calibration and testing of field equipment and instrumentation;
- Commissioning and tuning of the Low NO_x Combustion Firing System; and
- Post outage performance testing of the Low NO_x Combustion Firing System.

Justification

1. Why Do This Project?

As specified in Schedule C of the Air Quality Regulations (N.S. Reg. 28/2005), NSPI has a regulatory requirement to limit annual NO_x emissions to 21,365 tonnes starting in 2009. Installation of Low NO_x Combustion Firing Systems on NSPI solid fuel generating units is the lowest cost option that will achieve the required NO_x reduction.

The installation of Low NO_x Combustion Firing systems on Lingan Unit 1, Point Tupper Unit 2, and Trenton Unit 6 comprise the third year of a four year program. Three prior LNCFS installations have been approved by the UARB and are nearing completion. Performance achieved to date has reinforced the original NOx reductions forecast for this program.

2. Why Do This Project Now?

The projects planned for 2008 on Lingan Unit 1, Point Tupper Unit 2, and Trenton Unit 6 are required for NSPI to comply with provincial regulations in 2009. Continuing the NO_x reduction program in 2008 allows NSPI to align these installations with planned maintenance outages and assess the performance of completed retrofits to determine

whether further investment in this program is required and refine processes as appropriate.

3. Why Do the Project This Way?

Low NO_x Combustion Firing Systems incorporating low NO_x burners and separated overfire air systems have been evaluated as the least cost technology capable of meeting the legislated NO_x reduction, effective 2009. The installed LNCFS on Lingan Unit 3 is approaching one year of service and the performance has been consistent with expected NO_x reduction levels. The results on Unit 3 confirm the NO_x reduction approach taken is capable of meeting the required NO_x reduction.

Implementation of these systems over a four year period allows alignment with maintenance schedules and refinement to installation processes as the program moves forward.

Business Drivers

Project Justification Criteria - Environmental

Low NOx retrofits to Lingan 1, Point Tupper 2 and Trenton 6 comprise Year 3 of NSPI's four year NOx Reduction Program. The installations are required to enable NSPI to reduce NO_x to the levels required by provincial regulations by 2009.

Success will be measured by:

1. Completion of low NO_x retrofits on Lingan Unit 1, Point Tupper Unit 2, and Trenton Unit 6 in accordance with established safety performance targets and within schedule and budget; and
2. Performance demonstration testing that confirms the specified performance guarantees have been achieved.

Schedule and Project Implementation

The following table provides a summary of the schedule of work included in the three capital projects.

Task	Lingan Unit 1	Pt Tupper Unit 2	Trenton Unit 6
Submission to UARB	September 2007		
Authorize vendor to proceed	November 2007		
Delivery to Site	August 2008	June 2008	April 2008
Start of Outage	September 2008	July 2008	May 2008
Completion of Work	October 2008	August 2008	June 2008
Guarantee Testing	November 2008	September 2008	July 2008

Air Quality Regulations

made under Section 112 of the
Environment Act
S.N.S. 1994-95, c. 1
O.I.C. 2005-87 (February 25, 2005, effective March 1, 2005), N.S. Reg. 28/2005

Citation
1 These regulations may be cited as the *Air Quality Regulations*.

Definitions
2 In these regulations,

(a) "Act" means the *Environment Act*;

(b) "Administrator" means a person appointed by the Minister under subsection 21(1) of the Act to administer these regulations, and includes an acting Administrator;

(c) "averaging period" in Schedule A means that period of time over which an arithmetic mean or geometric mean, as the case may be, is calculated;

(d) "designated material" means a material described in Schedule B to these regulations;

(e) "facility" includes a petroleum refinery;

(f) "heavy fuel oil" means petroleum residual fuel that is used in liquid-fuel-burning equipment;

(g) "Minister" means the Minister of Environment and Labour.

Ambient air quality criteria
3 (1) The criteria for ambient air quality throughout the Province are prescribed in Schedule A and are expressed as maximum permissible ground level concentrations.

(2) An approval issued by the Minister or an Administrator must contain provisions to ensure that the maximum permissible ground level concentrations prescribed in Schedule A are not exceeded.

Burning offences
4 (1) Except as provided in subsection (2) and except as provided in the *Used Oil Regulations*, a person must not carry out, cause, permit or be responsible for the burning of a designated material without prior written authorization from the Minister or an Administrator.

(2) Subsection (1) does not apply to burning conducted by a person or organization that is authorized by the Province to conduct courses to train fire-fighting personnel.

Gasoline volatility limit
5 (1) In this Section, "motor gasoline" means gasoline intended for use as motor fuel.

(2) The volatility limit for the vapour pressure of motor gasoline is 72 kPa.

(3) During the period from May 15 to September 15 in each year, both dates inclusive,

(a) a person who refines motor gasoline must not cause or permit any motor gasoline intended for use in the Province to leave the refinery if the motor gasoline's vapour pressure exceeds the volatility limit; and

(b) a person who imports into the Province any motor gasoline that has a vapour pressure that exceeds the volatility limit must not cause or permit

(i) the transfer of possession of the motor gasoline; or

(ii) the transfer of the motor gasoline from one container to another.

(4) The vapour pressure of motor gasoline must be determined in accordance with

(a) procedure *D 5191--01 Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method)* prepared by the American Society for Testing Materials, as amended from time to time; or

(b) a procedure approved in writing by the Minister or an Administrator.

Provincial emission cap
6 (1) The Provincial annual sulphur dioxide emission cap is

(a) effective April 11, 1995, 189 000 t;

(b) effective March 1, 2005, 141 750 t.

(2) A person who owns, operates or is responsible for facilities that release emissions in excess of 90 tonnes of sulphur dioxide per year in the aggregate must, not later than February 15 of each year or as otherwise directed by an Administrator, in a form specified by the Administrator, submit a report to the Minister or an Administrator on the sulphur throughput, noting the fuel usage, sulphur content and corresponding sulphur dioxide emissions for the previous calendar year from each facility owned or operated by, or under the responsibility of, the person.

(3) Subject to subsection (4), annual sulphur dioxide, nitrogen oxide and mercury emission allocations are assigned to persons listed in Schedule C in the amounts set out in that Schedule.

(4) For the purposes of achieving environmental quality standards and objectives in a cost-effective manner, compliance with an annual emission allocation assigned in Schedule C may be achieved by the inclusion of permits or allowances obtained under any emissions trading program established by the Minister under Section 15 of the Act or by an Administrator to whom the Minister has delegated the appropriate authority under Section 17 of the Act.

(5) If the annual emission allocation assigned in Schedule C for a substance is exceeded, the person responsible must, unless exempted in writing by the Minister because of unusual and unavoidable circumstances,

(a) within the 3 years following the calendar year in which the excess emissions occurred, compensate for the excess emissions by reducing annual emissions of the substance to a level below the annual allocation assigned for the substance in order to result in a total reduction of emissions of the substance equal to the amount of the excess emissions, in accordance with a plan submitted under clause (b) and approved by the Minister or an Administrator; and

(b) not later than February 15 of the year following the calendar year in which the excess emissions occurred, submit a plan indicating how the excess emissions will be recovered to the Minister or an Administrator for approval.

Emission reduction plans

7 (1) A person who owns, operates or is responsible for facilities that existed in 2001 and that release emissions in excess of 90 tonnes of sulphur dioxide per year in the aggregate must submit to an Administrator an emission reduction plan demonstrating the proposed means to achieve sulphur dioxide emission reductions of 25% from 2001 levels by 2010 for facilities owned or operated by, or under the responsibility of, the person.

(2) An emission reduction plan must be submitted not later than December 31, 2007, in accordance with specifications issued by the Minister or an Administrator.

Sulphur content of heavy fuel oil consumed in a facility other than a petroleum refinery

8 (1) Effective July 1, 2005, the sulphur content of heavy fuel oil consumed in a facility other than a petroleum refinery must not exceed

(a) 2.2% by mass; and

(b) 2.0% on an annual basis.

(2) A person who owns, operates or is responsible for a facility that consumes heavy fuel oil must make available to an Administrator, upon request, a report noting fuel type and usage, sulphur content and corresponding average sulphur levels for heavy fuel oil consumed in the previous calendar year at each facility owned or operated by, or under the responsibility of, the person.

Sulphur content of total fuel consumed in a petroleum refinery
9 (1) Effective July 1, 2005, the sulphur content of the total fuel consumed in a petroleum refinery must not exceed

(a) 2.2% by mass; and

(b) 2.0% on an annual basis.

(2) A person who owns, operates or is responsible for a petroleum refinery that consumes heavy fuel oil must make available to an Administrator, upon request, a report noting fuel type and usage, sulphur content and corresponding average sulphur levels for total fuel consumed in the previous calendar year at each refinery owned or operated by, or under the responsibility of, the person.

Reporting and records
10 (1) A person who is required to report under subsection 8(2) or subsection 9(2) must maintain all records of reported details for 5 years.

(2) A person who acquires a facility that consumes heavy fuel oil must obtain and maintain the records retained under subsection (1) from the person from whom the facility was transferred.

Schedule A
Maximum Permissible Ground Level Concentrations

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration	
		$\mu g/m^3$	pphm
Carbon Monoxide (CO)	1 hour	34 600	3000
	8 hours	12 700	1100
Hydrogen Sulfide (H_2S)	1 hour	42	3
	24 hours	8	0.6
Nitrogen Dioxide (NO_2)	1 hour	400	21
	Annual	100	5
Ozone (O_3)	1 hour	160	8.2
Sulphur Dioxide (SO_2)	1 hour	900	34
	24 hours	300	11

	Annual	60	2
Total Suspended Particulate (TSP)	24 hours	120	-
	Annual	70*	-

* - geometric mean
$\mu g/m^3$ - micrograms per cubic metre
pphm - parts per hundred million

Schedule B
Designated Materials

(1) a tire

(2) waste dangerous goods as defined in the *Dangerous Goods Management Regulations*

(3) used oil as defined in the *Used Oil Regulations*

(4) a railway tie or other wood treated with wood preservative

(5) a material containing rubber or plastic

(6) an asphalt shingle

Schedule C
Annual Sulphur Dioxide, Nitrogen Oxide and Mercury

Emission Allocations for Nova Scotia Power Incorporated

1 Sulphur dioxide

(1) Commencing in 1995, and in each year thereafter until March 1, 2005, the annual emissions of sulphur dioxide from fossil fuel-fired thermal power generating stations owned or operated by Nova Scotia Power Incorporated and affiliated companies must not in any calendar year exceed, in the aggregate, 145 000 t.

(2) Effective March 1, 2005, and in each calendar year thereafter until December 31, 2009, the annual emissions of sulphur dioxide from fossil fuel-fired thermal power generating stations owned or operated by Nova Scotia Power Incorporated and affiliated companies must not in any calendar year exceed, in the aggregate, 108 750 t.

(3) For the year 2005 only, the annual sulphur dioxide emissions cap allocated under item

(2) may be prorated on the basis of the effective date of these regulations, as authorized in writing by the Minister.

(4) Commencing in 2010, and in each calendar year thereafter, the annual emissions of sulphur dioxide from fossil fuel-fired thermal power generating stations owned or operated by Nova Scotia Power Incorporated and affiliated companies must not in any calendar year exceed, in the aggregate, 72 500 t.

2 Nitrogen oxide

(1) Commencing in 2009, and in each calendar year thereafter, the annual emissions of nitrogen oxides (NOx) from fossil fuel-fired thermal power generating stations owned or operated by Nova Scotia Power Incorporated and affiliated companies must not in any calendar year exceed, in the aggregate, 21 365 t.

(2) Commencing in 2010, and in each calendar year thereafter, a report must be submitted to the Minister or an Administrator noting the nitrogen oxide (NOx) emissions for the previous calendar year from each fossil fuel-fired thermal power generating station owned or operated by Nova Scotia Power Incorporated and affiliated companies. The report must be submitted not later than February 15 of each calendar year, or as otherwise directed by an Administrator, in a form specified by the Administrator.

3 Mercury

(1) Commencing March 1, 2005, and in each calendar year thereafter, the annual emissions of mercury from coal-fired thermal power generating stations owned or operated by Nova Scotia Power Incorporated and affiliated companies must not in any calendar year exceed, in the aggregate, 168 kg.

(2) Commencing January 1, 2006, and in each calendar year thereafter, a report must be submitted to the Minister or an Administrator noting the mercury emissions for the previous calendar year from each coal-fired thermal power generating station owned or operated by Nova Scotia Power Incorporated and affiliated companies. The report must be submitted not later than February 15 of each year, or as otherwise directed by Administrator, in a form specified by the Administrator.

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Last updated: 10-08-2005

Appendix II

Capital Project Estimate Sheet

Name of Project: Lingan Unit 1 - Low NOx Combustion Firing System- JULY 20,2007 ESTIMATE			
Project No.	Division Power Production Generation Services		Estimated Completion Date: 2008
Capital Item No.	Responsibility Code 05130000		Function
Estimated By: Bill Small		Approved by: Doug Campbell	Date: Sept 10, 2007

Accounting Flexfield					Description	Total Cost	Quantity	Unit
CO	ACCT	ACTIV	CC	PROJ				
					Activity 005 - Indirect Costs Includes administrative and financing costs of construction.			
2	094	005	301		Interest Capitalized	$104,000.00		
2	095	005	301		Construction Overhead	$134,620.00		
					Total Activity 005 Indirect Costs =	**$238,620.00**		
					Activity 013 - Boiler Will include the design, supply, erection, commissioning and testing of a low NOx combustion firing system for Lingan Unit 3.			
2	001	013	301		Regular Labour	$130.000.00		
2	002	013	301		Overtime Labour	$20,000.00		
2	004	013	301		Term Labour	$20,000.00		
2	011	013	301		Travel	$3,000.00		
2	012	013	301		Materials	$1,710,800.00		
2	013	013	301		Contracts	$1,725,000.00		
2	041	013	301		Meals	$1,000.00		
					Total Activity 013 Boiler =	**$3,609,800.00**		
					Activity 085 - Design Includes the costs of salaries, travel and living expenses of all NSPI regular and casual staff including project management, design, CADD, plant, procurement, legal, scheduling, cost control, etc assigned to the Project			
2	001	085	301		Regular Labour	$165,000.00		
2	011	085	301		Travel	$15,000.00		
2	012	085	301		Materials	$1,500.00		
2	028	085	301		Consulting	$115,000.00		
2	041	085	301		Meals and Entertainment	$5,000.00		
					Total Activity 085 Design =	**$301,500.00**		
					Total Project	**$4,149,920.00**		

Capital Project Estimate Sheet

Name of Project: Pt. Tupper Unit 2 - Low NOx Combustion Firing System JUNE, 2007 ESTIMATE			
Project No.	Division Power Production Generation Services		Estimated Completion Date: 2008
Capital Item No.	Responsibility Code 05130000		Function
Estimated By: Bill Small		Approved by:Doug Campbell	Date: Sept 10, 2007

Accounting Flexfield					Description	Total Cost	Quantity	Unit
CO	ACCT	ACTIV	CC	PROJ				
					Activity 005 - Indirect Costs Includes administrative and financing costs of construction.			
2	094	005	301		Interest Capitalized	$111,400.00		
2	095	005	301		Construction Overhead	$142,630.00		
					Total Activity 005 Indirect Costs =	**$254,030.00**		
					Activity 013 - Boiler Will include the design, supply, erection, commissioning and testing of a low NOx combustion firing system for Pt. Tupper Unit 2.			
2	001	013	301		Regular Labour	$100,000.00		
2	002	013	301		Overtime Labour	$21,000.00		
2	004	013	301		Term Labour	$20,000.00		
2	011	013	301		Travel	$2,000.00		
2	012	013	301		Supply of low NOx combustion firing system and associated equipment	$1,936,800.00		
2	013	013	301		Contracts	$1,805,000.00		
2	041	013	301		Meals	$1,000.00		
					Total Activity 013 Boiler =	**$3,945,800.00**		
					Activity 085 - Design Includes the costs of salaries, travel and living expenses of all NSPI regular and casual staff including project management, design, CADD, plant, procurement, legal, scheduling, cost control, etc assigned to the Project			
2	001	085	301		Regular Labour	$160,000.00		
2	011	085	301		Travel	$19,500.00		
2	012	085	301		Materials	$4,000.00		
2	028	085	301		Consulting	$115,000.00		
2	041	085	301		Meals and Entertainment	$6,100.00		
					Total Activity 085 Design =	**$304,600.00**		
					Total Project	**$4,504,430.00**		

Capital Project Estimate Sheet

Name of Project: TRENTON Unit 6 - Low NOx Combustion Firing System JULY, 2007 ESTIMATE			
Project No.	Division Power Production Generation Services		Estimated Completion Date: 2008
Capital Item No.	Responsibility Code 05130000		Function
Estimated By: Bill Small		Approved by:Doug Campbell	Date: Sept 10, 2007

Accounting Flexfield					Description	Total Cost	Quantity	Unit
CO	ACCT	ACTIV	CC	PROJ				
					Activity 005 - Indirect Costs Includes administrative and financing costs of construction.			
2	094	005	301		Interest Capitalized	$132,630.00		
2	095	005	301		Construction Overhead	$170,510.00		
					Total Activity 005 Indirect Costs =	**$303,140.00**		
					Activity 013 - Boiler Will include the design, supply, erection, commissioning and testing of a low NOx combustion firing system for Trenton Unit 5.			
2	001	013	301		Regular Labour	$150,000.00		
2	002	013	301		Overtime Labour	$20,000.00		
2	004	013	301		Term Labour	$20,000.00		
2	011	013	301		Travel	$2,000.00		
2	012	013	301		Supply of low NOx combustion firing system and associated equipment	$2,350,000.00		
2	013	013	301		Contracts	$2,450,000.00		
2	041	013	301		Meals	$1,000.00		
					Total Activity 013 Boiler =	**$4,993,000.00**		
					Activity 085 - Design Includes the costs of salaries, travel and living expenses of all NSPI regular and casual staff including project management, design, CADD, plant, procurement, legal, scheduling, cost control, etc assigned to the Project .			
2	001	085	301		Regular Labour	$160,000.00		
2	011	085	301		Travel	$28,000.00		
2	012	085	301		Materials	$3,500.00		
2	028	085	301		Consulting	$115,000.00		
2	041	085	301		Meals and Entertainment	$5,000.00		
					Total Activity 085 Design =	**$311,500.00**		
					Total Project	**$5,607,640.00**		