Blue Source's Project Description Report of International Paper's Natural Gas Turbine Cogeneration Facility Project
(January 2001 – December 2004)

TABLE OF CONTENTS

1.0 Introduction

International Paper is the world's largest paper and forest products company. Its core businesses include paper, packaging and forest products. IP has operations in more than 40 countries, employs more than 90,000 people and exports its products to more than 120 nations. Through Forest Resources, International Paper is the largest private landowner in the United States with 8.3 million acres of forestland. International Paper was recently named by Fortune Magazine as the Most Admired Forest and Paper Products Company.

International Paper has approximately 200 manufacturing facilities in the U.S. Ninety percent of IP's greenhouse gas emissions in the United States come from their thirty largest facilities, specifically pulp and paper mills. International Paper is implementing several different technologies in order to reduce their energy needs and the associated emissions at these facilities. IP is increasing the use of biomass fuels (including wood waste and black liquor) to eliminate waste and reduce fossil fuel carbon dioxide emissions. They are continually reducing their energy usage through process changes. Through IP's desire for continuous improvement and implementation of new technologies, their U.S. greenhouse gas emissions are being reduced by almost 2 million tonnes annually.

In 2001, International Paper joined the EPA's Combined Heat and Power (CHP) Partnership, a voluntary organization whose members are committed to reducing negative environmental and social effects of electricity and power generation. The EPA describes cogeneration as "an efficient, clean and reliable approach to generating power and thermal energy from a single fuel source. By recycling this waste heat, CHP systems achieve typical effective electric efficiencies[1] of 50% to 70% -- a dramatic improvement over the average 33% efficiency of conventional fossil-fueled power plants. Higher efficiencies reduce air emissions of nitrous oxides, sulfur dioxide, mercury, particulate matter, and carbon dioxide".

A gas turbine cogeneration facility was commissioned at the International Paper mill in Bucksport, Maine in January 2001. International Paper uses tools for calculating greenhouse gases from pulp and paper mills developed by the World Resources Institute and International Council of Forest and Paper Association. Due to the joint ownership of the cogeneration unit, this report follows closely the World Resources Institute (WRI) GHG Protocol's recommended guidance and calculation methodology for allocating greenhouse gas emissions from combined heat and power (CHP) systems.

[1] Effective electric efficiency is the net electric output divided by the effective fuel input. Effective fuel input is the total fuel used by the CHP system minus the fuel that would be used by an 80% efficient boiler to generate the same amount of steam as produced by the CHP system.

2.0 Proponent Identification

The contact information for the emission reduction project is as follows:

Proponent Contact: William L. Townsend
CEO
Blue Source, LLC
48 W. Market Street, Suite 220
Salt Lake City, Utah 84101
Phone – (801) 322-4750
Fax – (801) 363-3248
E-mail – wlt@ghgworks.com

Operating Contacts: Douglas Stilwell
Manager, Environmental Audits
Corporate Environment
International Paper
6400 Poplar Avenue
Memphis, Tennessee 38197
Phone – (901) 419-3897
Fax – (901) 419-3962
E-mail – Douglas.stilwell@ipaper.com

Joe Lynch
Senior Environmental Engineer
Bucksport Mill
River Road
Post Office Box 1200
Bucksport, Maine 04416
Phone – (207) 469-1282
Fax – (207) 469-1703
E-mail – Joe.Lynch@ipaper.com

The location of the emission reduction source is as follows:

International Paper Bucksport Mill
River Road
Bucksport, Maine 04416

3.0 Project Description

3.1 Pre-Project Conditions

International Paper consumes significant amounts of electricity and steam at the pulp and paper mill in Bucksport, Maine due to the nature of the mechanical processing operations at this facility. To create both electricity and steam for use on-site, International Paper operated four power boilers. Power Boilers #5, #6, #7 used residual fuel oil no. 6. Power Boiler #8, a multi-fuel boiler was fueled with bituminous coal, tire derived fuel, waste oil no.2, hog fuel and biomass sludge. These boilers created high pressure steam that was fed to steam turbines #2 and #3 to produce electricity. The turbines also produce low pressure steam used for processing at the mill. International Paper also exported a significant amount of electricity and purchased a significant amount of electricity from the grid.

3.2 Project Strategy

Due to both the mechanical/electrical and thermal energy needs of the Bucksport facility, it was an ideal candidate for installation of a gas turbine cogeneration unit to service both the mill and surrounding electricity demand. Cogeneration, or combined heat and power systems, are efficient means of creating useable thermal and electrical energy. The ability to generate electrical/mechanical and thermal energy simultaneously allows for the recovery of much of the energy normally lost in separate generation. Heat produced from the electricity generating process is captured and utilized to produce high and low level steam. The steam can be used as a heat source and can be used in steam turbines to generate additional electricity. The high overall efficiency of cogeneration means it creates less than a third of the greenhouse gases per unit of useful energy compared with conventional energy supply systems. The new gas turbine cogeneration unit installed at the mill consumes natural gas and a small amount of diesel. Gas turbines are one of the cleanest means of generating electricity because of their relatively high efficiency and reliance on natural gas as the primary fuel. The associated greenhouse gas emission factors for steam and electricity production are significantly lower than the mill's power boiler cogeneration unit (consuming coal). Thus, the gas turbine is able to produce the same amount of thermal and electrical energy with fewer greenhouse gas emissions than the original power boilers at the mill. The gas turbine cogeneration unit consists of a gas turbine and a heat recovery steam generator. The combustion turbine is used to drive an electrical generator, and thermal energy is recovered from the exhaust stream to make steam for use in processing at the mill.

The gas turbine cogeneration unit was constructed at International Paper's mill in Bucksport during 2000. On October 24, 2000, the gas turbine was fired for the first time. Testing continued throughout November and December and commissioning of the facility took place January 19, 2001. International Paper is the operator of the gas turbine cogeneration unit and has a 28% equity share in the unit.

3.3 Post-Project Conditions

Due to the added electricity and steam generation capacity of the cogeneration unit, the mill was able to phase out Power Boilers #6 and #7 and Power Boiler #8 no longer consumes coal and instead runs on biomass sludge, hog fuel, tire derived fuel and residual fuel oil #6. All steam produced from the gas turbine cogeneration unit is consumed on site by the mill. Approximately 25% of the electricity created from the cogeneration unit is used by the mill and the remaining 75% is sent to the grid.

4.0 Mandatory Criteria for Emission Reductions

4.1 Real

For the International Paper cogeneration project, the emission reduction is real because it represents an actual and recognizable action that resulted in direct reduction of carbon dioxide emissions created through electricity and steam production. This greenhouse gas emission reduction resulted solely from International Paper's investment in the cogeneration unit and consumption of steam created by the unit, and did not result from a mere change in the level of business activity (i.e., there was no decrease in production from the pre-project condition to the post-project condition).

4.2 Surplus

There are no external requirements for controlling or reducing energy use or CO_2 emissions from pulp and paper facilities or electric generating facilities in the United States. The Bucksport mill and Bucksport Clean Energy facility are not subject to any federal, state or local regulations that require carbon dioxide emission reductions.

4.3 Quantifiable

All calculations were performed using the WRI calculation tools for direct emissions from stationary combustion, including combined heat and power allocations. Calculations require types and quantities of fuel burned and associated emission factors. Default values suggested by WRI were used where specific data was unavailable.

4.4 Unique

Greenhouse gas emission reductions from International Paper's Gas Turbine Cogeneration Project have not been previously transferred or sold and are captured under Blue Source's greenhouse gas emission reduction sourcing contract dated September 17, 2004.

4.5 Verifiable

The data sources used to develop the emission reductions are readily verifiable for third party review. International Paper completes a greenhouse gas inventory for the Bucksport mill annually using calculation tools provided by the International Council of Forest & Paper Association in conjunction with World Resources Institute. Measurement data records are managed by International Paper and are readily available for audit. Sample calculations for the emission reductions are provided in Section 5.0. These calculations are presented in a manner to facilitate simple external review. In addition, all assumptions are documented and data sources are referenced.

5.0 Quantification of Emission Reductions

5.1 Baseline Emissions

The baseline emissions consist of both the direct and indirect emissions associated with creating both the electric/mechanical and thermal energy to meet the needs of the mill's processing operations and electricity exports. All direct emissions are a result of multiple boilers used to create both steam and electricity for use on-site. Boilers #5, #6, #7 operated on residual fuel oil no. 6, and Boiler #8 consumed coal, tire derived fuel, waste oil no. 2, biomass sludge and hog fuel. Baseline emissions resulting from the combustion of fuels in the boilers were calculated using emission factors from WRI's stationary combustion calculation tools.

Emission factors for both steam and electricity in the baseline boiler scenario were calculated using 1999 data. Calculations for 1999 are shown below.

<u>Sample Calculation - Boiler Emissions</u>

Boiler #5 – Residual Oil No. 6

$$11{,}759{,}790\,gallons \times \frac{BBL}{42\,gallons} \times \frac{486.31\,kgCO_2e}{BBL} \times \frac{tonneCO_2e}{1000\,kgCO_2e} = 136{,}164\,tonnesCO_2e$$

International Paper records consumption of bituminous coal, tire derived fuel, hog fuel and biomass sludge in wet tons. All WRI emission factors are based on dry tons. Thus the equations below include a conversion from wet tons to dry tons based on moisture content data provided by International Paper.

Boiler #8 – Bituminous Coal

$$70{,}778\,tons \times (1-0.0478) \times \frac{2646.09\,kgCO_2e}{ton} \times \frac{tonneCO_2e}{1000\,kgCO_2e} = 178{,}332\,tonnesCO_2e$$

Boiler #8 consumed hog fuel and biomass sludge, fuels recovered from the mill's waste and process streams[2]. These fuels are considered carbon neutral. Thus, the carbon dioxide emissions are not included, but the methane and nitrous oxide emissions from

[2] "Energy-rich biomass – derived from wood chips, bark, sawdust and pulping liquors recovered from the harvesting and manufacturing processes – is the result of atmospheric carbon dioxide being sequestered by trees during growth and transformed into organic carbon substances. When these biomass fuels are burned, the CO_2 emitted during the manufacturing and combustion processes is the atmospheric carbon dioxide that was sequestered during growth of the tree; hence, there is no net contribution to the atmospheric CO_2 level. This carbon cycle is a closed-loop. New tree growth keeps absorbing atmospheric carbon dioxide and maintains the cycle. Any increases or decreases in the amount of carbon sequestered by the forests are accounted for in the comprehensive forest accounting system. This is the approach generally prescribed for national inventories by the United Nations Framework Convention on Climate Change. Most international protocols including that of the Intergovernmental Panel on Climate Change (IPCC) have adopted the convention set out by the United Nations. The IPCC has stated that emissions from biomass do not add to atmospheric concentrations of carbon dioxide" *International Association of Forest & Paper Association*.

combustion of these fuels are included. Biomass calculations include heating values provided by International Paper.

Boiler #8 – Biomass Sludge

$$205{,}800 tons \times (1 - .4885) \times \frac{2000 lbs}{1 ton} \times \frac{9450.6 BTU}{lb} \times \frac{MMBTU}{1{,}000{,}000 BTU} \times \frac{1.055 GJ}{MMBTU} \times \frac{1.49 kgCO_2e}{GJ} \times \frac{tonneCO_2e}{1000 kgCO_2e}$$

$$= 3{,}128 tonnesCO_2e$$

Table 1: Pre - Project Emissions - 1999
Bucksport Mill Stationary Combustion - Boilers

Source	Fuel type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Power Boiler # 5	Residual Oil No. 6	279,995	BBL	486.31	kg CO2 equiv. / BBL	136,164,368	136,164
Power Boiler # 6	Residual Oil No. 6	203,766	BBL	486.31	kg CO2 equiv. / BBL	99,093,443	99,093
Power Boiler # 7	Residual Oil No. 6	210,167	BBL	486.31	kg CO2 equiv. / BBL	102,206,314	102,206
Power Boiler # 8	Residual Oil No. 6	196,699	BBL	486.31	kg CO2 equiv. / BBL	95,656,691	95,657
Power Boiler # 8	Tire Derived Fuel	13,500	US TONS	2,148.46	kg CO2 equiv. / TON	28,496,150	28,496
Power Boiler # 8	Biomass	2,017,727	GJ	1.49	kg CO2 equiv./ GJ	3,127,657	3,128
Power Boiler # 8	Sludge	161,574	GJ	1.49	kg CO2 equiv./ GJ	235,480	235
Power Boiler # 8	Waste Oil No. 2	357	BBL	433.34	kg CO2 equiv. / BBL	154,764	155
Power Boiler # 8	Bituminous Coal; Tangential	67,395	US TONS	2,646.09	kg CO2 equiv. / TON	178,332,445	178,332
Total						643,467,312	643,467

The boilers create high-pressure steam that is fed to turbines to produce electricity. The turbine is also designed to produce low pressure steam to feed the industrial process. In a combined heat and power system, emissions are allocated based on the separate efficiencies of steam and electricity production. These calculations were performed using the WRI GHG Protocol’s “efficiency method”. The efficiency method attempts to relate energy outputs to the amounts of fuel used to generate them, and by extension, to the greenhouse gases produced in generating them. The simplified efficiency method uses assumed efficiency factors for the production of power and steam.

$$E_H = \left\{ \frac{H_{e_H}}{H_{e_H} + P_{e_P}} \right\} \times E_T$$

where: E_H *= emissions allocated to steam production, t GHG/y*
E_T *= total direct emissions of the CHP system (boilers), t GHG/y*
H = steam output, kWh/y
P = power output, kWh/y
e_H *= assumed efficiency of steam production (default = 0.8)*
e_P *= assumed efficiency of electricity generation (default = 0.35)*

The emission share attributable to electric power production is calculated using the following equation:

$$E_P = E_T - E_H$$

where: E_P *= emissions allocated to electric power production, t GHG/y*

Sample Calculation - Emissions allocation for Steam and Electricity Production

$$E_H = \left\{ \frac{1{,}583{,}776{,}205 kWh \div 0.8}{(1{,}583{,}776{,}205 kWh \div 0.8) + (644{,}714{,}000 kWh \div 0.35)} \right\} \times 643{,}467 tonnesCO_2e$$
$$= 333{,}324 tonnesCO_2e$$

$$E_P = 643{,}467 tonnesCO_2e - 333{,}324 tonnesCO_2e$$
$$= 310{,}143 tonnesCO_2e$$

Sample Calculation - Emission Factors for Steam and Electricity Production

For steam: $\frac{E_H}{H} = \frac{333{,}324 tonnesCO_2e}{1{,}583{,}776{,}205 kWh} \times \frac{1000 kgCO_2e}{1 tonneCO_2e} = 0.210462 kgCO_2e / kWh$

For electricity: $\frac{E_P}{P} = \frac{310{,}143 tonnesCO_2e}{644{,}714{,}000 kWh} \times \frac{1000 kgCO_2e}{1 tonneCO_2e} = 0.481055 kgCO_2e / kWh$

In order to accurately calculate emissions occurring in the baseline scenario, on site electricity generation and electricity import ratios were calculated based on 1999 data.

Sample Calculation – Electricity Generation and Electricity Import Ratios

For on-site electricity generation ratio: $\frac{E_g}{E_c} = \frac{444{,}740{,}588 kWh}{725{,}922{,}185 kWh} = 0.61$

For electricity import ratio: $\frac{E_i}{E_c} = \frac{281{,}181{,}597 kWh}{725{,}922{,}185 kWh} = 0.39$

Table 2: Baseline Annual Emissions
Bucksport Mill Electricity Generation

Year	Electricity Consumption (kWh)	On-site Electricity Generation Ratio	Electricity Generation (kWh)	Emission Factor (kg CO_2e / kWh)	Direct Emissions (kg CO_2e)	Emissions (tonnes CO_2e)
2001	694,358,567	0.61	425,402,948	0.48	204,642,344	204,642
2002	726,694,493	0.61	445,213,747	0.48	214,172,434	214,172
2003	761,685,395	0.61	466,651,133	0.48	224,485,002	224,485
2004	768,896,492	0.61	471,069,055	0.48	226,610,267	226,610

Table 3: Baseline Annual Direct Emissions
Bucksport Mill Steam Production

Year	Steam (kWh)	Emission Factor (kg CO_2e / kWh)	Emissions (kg CO_2e)	Emissions (tonnes CO_2e)
2001	1,364,384,475	0.21	287,150,669	287,151
2002	1,312,023,850	0.21	276,130,763	276,131
2003	1,419,031,448	0.21	298,651,764	298,652
2004	1,478,108,475	0.21	311,085,215	311,085

Table 4: Baseline Annual Emissions
Bucksport Mill Electricity Imports

Year	Source	Electricity Consumption (kWh)	Percent Import	Electricity Imports (kWh)	Emission Factor[1] (kg CO_2e / kWh)	Emissions (kg CO_2e)	Emissions (tonnes CO_2e)
2001	Central Maine Power	694,358,567	0.39	268,955,619	0.296	79,541,539	79,542
2002	Central Maine Power	726,694,493	0.39	281,480,746	0.342	96,370,997	96,371
2003	Central Maine Power	761,685,395	0.39	295,034,261	0.331	97,745,998	97,746
2004	Central Maine Power	768,896,492	0.39	297,827,437	0.300	89,282,476	89,282

1-Electricity is purchased from the grid, Central Maine Power is the distributor, and TransCanada is the supplier. A specific annual CO_2e emission factor for TransCanada's electricity generating facilities was used to calculate baseline emissions due to electricity purchases for each year.

5.2 Project Emissions

Project emissions were calculated in a manner similar to baseline emissions, though the project boundary expands to include the boilers at the mill and the gas turbine cogeneration unit. Emissions factors for steam and electricity are based on total electricity production, total steam production and total direct emissions from both the gas turbine cogeneration unit and boilers at the mill.

<u>Sample Calculation – Gas Turbine Cogeneration Unit Emissions</u>

Gas Turbine - Natural Gas Consumption - 2001

$$12{,}462.96 MMcf \times \frac{957 MMBTU}{MMcf} \times \frac{58.93 kgCO_2e}{MMBTU} \times \frac{tonneCO_2e}{1000 kgCO_2e} = 702{,}861 tonnesCO_2e$$

Table 5: Actual (Post-Project) Emissions 2001
Gas Turbine Cogeneration Unit

Fuel Type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Natural Gas	11,927,051	MMBtu	58.93	kg CO_2e / MMBtu	702,861,104	702,861
Diesel	1,438	BBL	433.34	kg CO_2e / BBL	622,998	623
Total						703,484

Table 6: Actual (Post-Project) Emissions 2001
Mill Boilers

Source	Fuel type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Power Boiler # 5	Residual Oil No. 6	65,217	BBL	486.31	kg CO2 equiv. / BBL	31,715,549	31,716
Power Boiler # 6	Residual Oil No. 6	11,980	BBL	486.31	kg CO2 equiv. / BBL	5,826,143	5,826
Power Boiler # 7	Residual Oil No. 6	32,790	BBL	486.31	kg CO2 equiv. / BBL	15,945,878	15,946
Power Boiler # 8	Residual Oil No. 6	219,283	BBL	486.31	kg CO2 equiv. / BBL	106,639,724	106,640
Power Boiler # 8	Tire Derived Fuel	11,085	US TONS	2,148.46	kg CO2 equiv. / TON	23,815,726	23,816
Power Boiler # 8	Biomass	1,593,651	GJ	1.49	kg CO2 equiv. / GJ	2,462,164	2,462
Power Boiler # 8	Sludge	123,570	GJ	1.49	kg CO2 equiv. / GJ	146,164	146
Power Boiler # 8	Waste Oil No. 2	474	BBL	433.34	kg CO2 equiv. / BBL	205,321	205
Power Boiler # 8	Bituminous Coal; Tangential	3,044	US TONS	2,646.09	kg CO2 equiv. / TON	8,055,170	8,055
Total						194,811,839	194,812

<u>Sample Calculation – Emissions Allocations for Steam and Electricity Production</u>

$$E_H = \left\{ \frac{H_{e_H}}{H_{e_H} + P_{e_P}} \right\} \times E_T$$

$$E_P = E_T - E_H$$

$$E_H = \left\{ \frac{1{,}364{,}384{,}475 kWh \div 0.8}{(1{,}364{,}384{,}475 kWh \div 0.8) + (1{,}988{,}848{,}779 kWh \div 0.35)} \right\} \times (703{,}404 tonnes + 194{,}812 tonnes)$$

$$= 207{,}369 tonnes$$

$$E_P = 898{,}296 tonnes - 207{,}369 tonnes$$
$$= 690{,}926 tonnes$$

<u>Sample Calculation – 2001 Emission Factors for Steam and Electricity Production</u>

For steam: $\frac{E_H}{H} = \frac{207{,}369 tonnesCO_2e}{1{,}364{,}384{,}475 kWh} \times \frac{1000 kgCO_2e}{tonneCO_2e} = 0.152 kgCO_2e / kWh$

For electricity: $\frac{E_P}{P} = \frac{690{,}926 tonnesCO_2e}{1{,}988{,}848{,}779 kWh} \times \frac{1000 kgCO_2e}{tonneCO_2e} = 0.347 kgCO_2e / kWh$

Table 7: Actual (Post – Project) Emissions
Electricity Consumption from On-Site Generation

Year	Electricity (kWh)	Emission Factor (kg CO_2e / kWh)	Emissions (kg CO_2e)	Emissions (tonnes CO_2e)
2001	680,469,382	0.347	236,395,192	236,395
2002	718,137,375	0.336	241,102,010	241,102
2003	717,374,443	0.340	243,970,071	243,970
2004	747,400,520	0.328	245,146,516	245,147

Table 8: Actual (Post-Project) Emissions
Steam Production

Year	Steam (pounds of 1000 Btu Steam)	Steam (kWh)	Emission Factor (tonnes kg CO_2e / kWh)	Emissions (kg CO_2e)	Emissions[1] (tonnes CO_2e)
2001	4,655,472,597	1,364,384,475	0.152	207,369,498	207,369
2002	4,476,810,745	1,312,023,850	0.147	192,713,921	192,714
2003	4,841,935,791	1,419,031,448	0.149	211,135,242	211,135
2004	5,043,514,951	1,478,108,475	0.144	212,107,827	212,108

1-International Paper has a 28% equity share in the gas turbine cogeneration unit. International Paper's contract with the majority owners of the unit require IP, as the sole consumer of steam produced by the cogeneration unit, to consume 100% of the steam produced from the unit.

Table 9: Actual (Post-Project) Emissions
Electricity Imports

	Electricity Imports (kWh)	Emission Factors (kg CO_2e / kWh)	Emissions (kg CO_2e)	Emissions (tonnes CO_2e)
2001	13,889,185	0.29574	4,107,619	4,108
2002	8,557,118	0.34237	2,929,714	2,930
2003	44,310,952	0.33130	14,680,391	14,680
2004	21,495,972	0.29978	6,444,046	6,444

5.3 Emission Reductions

Emission reductions were calculated using the following equation:

Net Emission Reductions = Baseline Emissions – Actual Emissions

<u>Sample Calculation – Net Emission Reductions - 2001</u>

$$NetER = (287{,}151 tonnesCO_2e + 204{,}642 tonnesCO_2e + 79{,}542 tonnesCO_2e - (207{,}369 tonnesCO_2e + 236{,}395 tonnesCO_2e + 4{,}108 tonnesCO2e)$$
$$= 123{,}462 tonnesCO_2e$$

Table 10: Net Emission Reductions (tonnes CO_2e)

Year	Baseline Emissions Steam	Baseline Emissions Electricity	Baseline Emissions Electricity Imports	Actual Emissions Steam	Actual Emissions Electricity	Actual Emissions Electricity Imports	Net Emission Reductions
2001	287,151	204,642	79,542	207,369	236,395	4,108	123,462
2002	276,131	214,172	96,371	192,714	241,102	2,930	149,929
2003	298,652	224,485	97,746	211,135	243,970	14,680	151,097
2004	311,085	226,610	89,282	212,108	245,147	6,444	163,280

6.0 Documents Examined

NCASI for The Climate Change Working Group of the International Council of Forest and Paper Associations, *Calculation Tools for Estimating Greenhouse Gas Emissions from Pulp and Paper Mills,* Version 1.0.
http://www.ghgprotocol.org/standard/Current_Tools/pulp_&_paper.v1.0.xls
http://www.ghgprotocol.org/standard/Current_Tools/pulp_&_paper_guidancev1.0.pdf

United States Environmental Protection Agency, *Overview of CHP Technologies*, Combined Heat and Power Partnership.
http://www.epa.gov/chp/pdf/catalog_entire.pdf

Intergovernmental Panel on Climate Change (IPCC). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions (Volume 1). IPCC National Greenhouse Gas Inventory Program, November 26, 2001.
http://www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm

Intergovernmental Panel on Climate Change (IPCC). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (Volume 3). IPCC National Greenhouse Gas Inventory Program, November 20, 2001.
http://www.ipcc-nggip.iges.or.jp/public/gl/invs6.htm

Appendix

Table A-1: Bucksport Mill Electricity Summary (kWh)

Year	Generation			Exports		Imports
	Mill - G2	Mill - G3	Gas Turbine Unit	Gas Turbine Unit	Mill - G3	Mill
1999	111,488,000	533,226,000	0	0	199,973,412	281,181,597
2001	116,422,000	524,548,799	1,347,877,980	1,106,368,015	202,011,382	13,889,185
2002	119,826,000	466,282,685	1,480,322,700	1,135,613,700	212,680,310	8,557,118
2003	115,710,000	439,237,441	1,365,263,314	1,013,107,830	189,728,482	44,310,952
2004	79,544,000	481,784,860	1,411,982,280	1,024,877,164	201,033,456	21,495,972

Table A-2: Actual (Post - Project) Emissions 2002
Bucksport Mill Stationary Combustion – Boilers

Source	Fuel type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Power Boiler # 5	Residual Oil No. 6	38,547	BBL	486.31	kg CO2 equiv. / BBL	18,745,729	18,746
Power Boiler # 6	Residual Oil No. 6	1,031	BBL	486.31	kg CO2 equiv. / BBL	501,581	502
Power Boiler # 7	Residual Oil No. 6	0	BBL	486.31	kg CO2 equiv. / BBL	0	0
Power Boiler # 8	Residual Oil No. 6	134,481	BBL	486.31	kg CO2 equiv. / BBL	65,569,532	65,570
Power Boiler # 8	Tire Derived Fuel	10,750	US TONS	2,148.46	kg CO2 equiv. / TON	2,387,775	23,096
Power Boiler # 8	Biomass	1,545,503	GJ	1.49	kg CO2 equiv. / GJ	115,506	2,388
Power Boiler # 8	Sludge	97,651	GJ	1.49	kg CO2 equiv. / GJ	23,095,777	116
Power Boiler # 8	Waste Oil No. 2	350	BBL	433.34	kg CO2 equiv. / BBL	151,669	152
Power Boiler # 8	Bituminous Coal; Tangential	0	US TONS	2,646.09	kg CO2 equiv. / TON	0	0
Total						110,567,569	110,568

Table A-3: Actual (Post - Project) Emissions 2003
Bucksport Mill Stationary Combustion - Boilers

Source	Fuel type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Power Boiler # 5	Residual Oil No. 6	59,176	BBL	486.31	kg CO2 equiv. / BBL	28,778,015	28,778
Power Boiler # 6	Residual Oil No. 6	0	BBL	486.31	kg CO2 equiv. / BBL	0	0
Power Boiler # 7	Residual Oil No. 6	0	BBL	486.31	kg CO2 equiv. / BBL	0	0
Power Boiler # 8	Residual Oil No. 6	159,318	BBL	486.31	kg CO2 equiv. / BBL	77,477,802	77,478
Power Boiler # 8	Tire Derived Fuel	12,049	US TONS	2,148,46	kg CO2 equiv. / TON	25,887,372	25,887
Power Boiler # 8	Biomass	1,637,119	GJ	1.49	kg CO2 equiv. / GJ	2,439,307	2,439
Power Boiler # 8	Sludge	106,857	GJ	1.49	kg CO2 equiv. / GJ	159,217	159
Power Boiler # 8	Waste Oil No. 2	968	BBL	433.34	kg CO2 equiv. / BBL	419,411	419
Power Boiler # 8	Bituminous Coal; Tangential	0	US TONS	2,646.09	kg CO2 equiv. / TON	0	0
Total						135,161,124	135,161

Table A-4: Actual (Post - Project) Emissions 2004
Bucksport Mill Stationary Combustion - Boilers

Source	Fuel type	Quantity of Fuel burned	Units	CO_2e emission factor	Units	CO_2e emissions (kg)	CO_2e emissions (tonnes)
Power Boiler # 5	Residual Oil No. 6	31,146	BBL	486.31	kg CO2 equiv. / BBL	15,146,764	15,147
Power Boiler # 6	Residual Oil No. 6	0	BBL	486.31	kg CO2 equiv. / BBL	0	0
Power Boiler # 7	Residual Oil No. 6	0	BBL	486.31	kg CO2 equiv. / BBL	0	0
Power Boiler # 8	Residual Oil No. 6	130,866	BBL	486.31	kg CO2 equiv. / BBL	63,641,560	63,642
Power Boiler # 8	Tire Derived Fuel	11,245	US TONS	2,148.46	kg CO2 equiv. / TON	24,158,615	24,159
Power Boiler # 8	Biomass	1,463,819	GJ	1.49	kg CO2 equiv./ GJ	2,181,091	2,181
Power Boiler # 8	Sludge	106,732	GJ	1.49	kg CO2 equiv./ GJ	159,031	159
Power Boiler # 8	Waste Oil No. 2	860	BBL	433.34	kg CO2 equiv. / BBL	372,466	372
Power Boiler # 8	Bituminous Coal; Tangential	0	US TONS	2,646.09	kg CO2 equiv. / TON	0	0
Total						105,659,527	105,660

Table A-5: Actual (Post – Project) Emissions
Gas Turbine Cogeneration Unit

Year	**Fuel**	**Quantity**	**Units**	**Emission Factor**	**Units**	**Emissions (kg CO_2e)**	**Emissions (tonnes CO_2e)**
2001	Natural Gas	11,927,051	MMBtu	58.93	kg CO2e/MMBtu	702,861,104	702,861
	Diesel	1,438	BBL	433.34	kg CO2e/BBL	622,998	623
	Total						703,484
2002	Natural Gas	12,897,388	MMBtu	58.93	kg CO2e/MMBtu	760,043,049	760,043
	Diesel	36,626	BBL	433.34	kg CO2e/BBL	15,871,346	15,871
	Total						775,914
2003	Natural Gas	12,090,031	MMBtu	58.93	kg CO2e/MMBtu	712,465,514	712,466
	Diesel	38,188	BBL	433.34	kg CO2e/BBL	16,548,254	16,548
	Total						729,014
2004	Natural Gas	12,598,397	MMBtu	58.93	kg CO2e/MMBtu	742,423,525	742,424
	Diesel	26,004	BBL	433.34	kg CO2e/BBL	11,268,573	11,269
	Total						753,692

Table A-6: Electricity Import Emission Factors – TransCanada

Year	**2001**	**2002**	**2003**	**2004**
Emission Factor (lb CO_2e / MWh)	652.0	754.8	730.4	660.9
Conversion to kg CO_2e / kWh	0.00045	0.00045	0.00045	0.00045
Emission Factor (kg CO_2e / kWh)	0.29574	0.34237	0.33130	0.29978
Emission Factor (tonne CO_2e / kWh)	0.00030	0.00034	0.00033	0.00030