Greenfield Gas Project, Phase III: Cost-Benefit Analysis Methodology

How to use this template:

This template is divided into a number of worksheets. Each worksheet forms a part of the overall analysis. The analysis comes together in *Sheet 5 - Financial Analysis* , which can also be used to do a cost-benefit analysis for the data provided. The worksheets are linked such that information can be entered in one place, and changes will be made throughout the analysis. The template is illustrative of the type of information one would need in order to assess possible costs and benefits related to the introduction of natural gas to greenfield communities.

Sheet 2 - Costs

This sheet describes the costs of running any necessary pipeline, including lateral and distribution systems. It can include any and all project costs, such as the construction of metering stations and other pipeline-related structures.
Sheet 2 also shows the amortization of costs over an 8-year period, covering approximately 30% of the costs in the first year. These percentages can be modified based on the specific case study or situation at hand.

Sheet 3 - Benefits

The Benefits sheet takes the forecast number of users on the system, the forecast price of natural gas, and the comparitive price differences between competing, alternative fuels (usually furnace oil and #6 fuel oil, but can include electricity, wood, propane, etc).

Each community will have different proposed take-up rates, depending on the competitiveness of alternative fuels, the proportion of each fuel currently in use, and the distribution of energy usage between user classes (e.g. residential, commercial, industrial). The Benefits sheet requires knowledge about current energy usage patterns for user classes and prices of competing fuels. Take up rates and forecast demand by user class can be modified to suit the specific case study area.

The Benefits sheet calculates gross revenues from natural gas sales, as well as describes savings attributable to energy-switching to natural gas. Sheets 2 and 3 work together later, in Sheet 5 - Financial Analysis.

Sheet 4 - Energy Demand

Sheet 4 describes the greenfield area, in terms of user-class and forecast demand for natural gas. This section directly influences the Benefits sheet, by reflecting the take-up rates for each user class, which will in turn affect gross revenues attributable to natural gas sales. Sheet 4 can be modified to reflect quicker, or slower take-up rates.

If the exact number of users is known, the tables can be modified to reflect total number of users. Likewise, if exact energy usage by user class is known, these tables can reflect that information and carry it forward to the benefits sheet.

Sheet 5 - Financial Analysis

Sheet 5 serves as a financial analysis sheet, as well as a cost-benefit analysis sheet, depending on the test variable.
As a financial analysis, revenues attributable to the sale of natural gas, less the cost of gas, are compared with the cost of construction and operations & maintenance costs on a year-by-year basis. Cost-benefit analysis adds in the benefit that consumers enjoy by switching to a lower-cost fuel, offsetting the costs attributable to the pipeline system.

Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 2 - Costs

Cost Calculations

Note:	Blue cells require data entry											
	Red cells are calculated values											
	All values should be in constant 2002 prices.											
Capital Costs												
Laterals												
Site Preparation	Cost per KM	KM	Cost ($)									
Steel Pipe	Cost per KM	KM	Cost ($)	(costs are quoted as installed)								
NPS 8 (219.1mm)			20,000,000									
NPS 6 (168.3 mm)			30,000,000									
Station Costs			2,000,000									
contingency (15%)			7,800,000									
Installation	Cost per KM	KM	Cost ($)									
Distribution												
Steel/Plastic Pipe	Cost per KM	KM	Cost ($)									
NPS 2 steel												
NPS 2 Plastic			30,000,000									
NPS 1 1/4 Plastic												
Installation	Cost per KM	KM	Cost ($)									
Total Capital Costs			89,800,000		Spread Over Time							
					Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
					30%	10%	10%	10%	10%	10%	10%	10%
					Capital Costs by Year							
					59,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000

Operation & Maintenance		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Annual Cost per KM		2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554
(lateral)	# of KM	150	150	150	150	150	150	150	150	150	150	150
(distribution)		8,000	304,000	370,000	515,000	556,000	660,000	789,000	843,000	869,000	957,000	1,138,000
Total O&M costs	Cost ($)	391,100	687,100	753,100	898,100	939,100	1,043,100	1,172,100	1,226,100	1,252,100	1,340,100	1,521,100

O&M on the distribution system can be calculated as a function of the number of users on the system.
In this case, total estimates were available, but have been estimated in other studies at $100.00 per user.

Benefit Calculations

Note: Blue cells require data entry
Red cells are calculated values
All values should be in constant 2002 prices.

Calculated by estimating quantity of gas consumed (average consumption times number of consumers) and multiplying by the price of natural gas

Expressed as a decimal,i.e., 2% = 1.02

1. Private - Sales of Natural gas

	Average Annual Growth Rate	Starting Average Consumption (GJ)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Residential	1	0	130	130	130	130	130	130	130	130	130	130	130
Commercial	1	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650
Small/Med Industrial	1	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Large Industrial	1	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Industrial	1	787,500	787,500	787,500	787,500	787,500	787,500	787,500	787,500	787,500	787,500	787,500	787,500

	Average Annual Growth Rate	Starting Number of Gas Consumers	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Residential	1	0	392	783	1,370	1,958	2,741	3,524	4,307	5,286	6,461	9,006	9,691
Commercial	1	0	14	29	43	57	71	86	100	114	129	166	183
Small/Med Industrial	1	0	3	8	16	24	30	32	34	35	37	42	45
Large Industrial	1	0	72	72	72	72	72	72	72	72	72	72	72
Very Large Industrial	1	0	2	2	2	2	2	2	2	2	2	2	2

Natural Gas Consumption	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Residential	0	50,901	101,802	178,154	254,506	356,308	458,110	559,912	687,165	839,869	1,170,726	1,259,803
Commercial	0	23,573	891,227	987,806	1,085,435	1,171,157	1,243,229	1,331,051	1,378,616	1,443,674	1,721,483	1,959,109
Small / Med Industrial	0	13,440	40,320	80,640	120,960	147,840	161,280	169,344	177,408	182,784	209,664	225,792
Large Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Very Large Industrial	0	0	0	0	0	0	0	0	0	0	0	0

Natural Gas Price (per GJ)	Average Annual Growth Rate	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Residential	1	15.34	15.34	15.34	15.34	15.34	15.34	15.34	15.34	15.34	15.34	15.34	15.34
Commercial	1	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25
Small / Med Industrial	1	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
Large Industrial	1	4.76	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628	4.7628
Very Large Industrial	1	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76

Natural Gas Sales	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Residential	0	781,031	1,562,061	2,733,607	3,905,154	5,467,215	7,029,276	8,591,338	10,543,915	12,887,007	17,963,706	19,330,510
Commercial	0	241,614	9,134,934	10,124,854	11,125,535	12,004,172	12,742,899	13,643,060	14,130,594	14,797,428	17,644,926	20,080,549
Small / Med Industrial	0	64,012	192,036	384,072	576,108	704,132	768,144	806,552	844,959	870,564	998,588	1,075,402
Large Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Very Large Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1,022,645	10,696,996	12,858,461	15,030,689	17,471,387	19,772,175	22,234,398	24,674,508	27,684,434	35,608,632	39,411,059

2. Estimated Energy Cost Savings
For existing energy consumers
To be estimated as the savings on energy consumption supplied by natural gas compared with the current alternative less the cost of converting to natural gas (equipment purchase, installation)

Assumed Efficiency rating is 97% for Natural Gas (Prices are Canadian Averages, Stats Canada Energy Statistics Handbook (2001)

Residential	Average Unit Current Consumption (1) (MMBtu)	Price per Unit	Efficiency Rating	Efficiency adjusted cost of alternative fuel (cents per MMBtu (2)	Energy (Efficiency) Adjusted Price of Natural Gas (cents per MMBtu (3)	Savings per MMBtu (4 = 2 - 3)	Savings per consuming unit (cents) (5 = 4*1)
- electricity	0	8.46c/kWh	0.99	2,503.57	1,505	998.39	0.00
- fuel oil	124	60.0 cents/l	0.72	2,078.35	1,505	573.17	70,963.92
- propane	0	65.22 cents/l	0.76	3,355.05	1,505	1,849.87	0.00
- wood	124	$121.74 /cord	0.45	754.79	1,505	-750.39	-92,905.73
Commercial							
- electricity	951	4.82 cents/kWh	0.99	1,426.38	1,005	420.92	400,132.74
- fuel oil (#2)	1,571	40 cents/l	0.72	1,385.57	1,005	380.11	597,310.21
- fuel oil (#6)	0	23 cents/l	0.79	1,110.93	1,005	105.46	0.00
- propane	1,571	65.22 cents/l	0.80	2,944.91	1,005	1,939.45	3,047,703.19

Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 3 - Benefits

- wood			0.45		1,005								
Small and Med Industrial													
- electricity	4,762	4.82 cents/kWh	0.99	1,426.38	467	959.17	4,567,498.10						
- fuel oil (#2)	4,762	40 cents/l	0.72	1,385.57	467	918.36	4,373,138.14						
- fuel oil (#6)	4,762	23 cents/l	0.79	1,110.93	467	643.72	3,065,320.00						
- propane	0	65.22 cents/l	0.80	2,944.91	467	2,477.70	0.00						
- wood	0		0.45										
Large Industrial													
- propane													
- fuel oil (#2)	9,524	40 cents/l	0.53	1,591.24	467	1,124.03	10,705,039.18						
- fuel oil (#6)	9,524	20 cents/l	0.53	726.35	467	259.14	2,468,047.06						
Very Large Industrial													
- propane						0.00	0.00						
- fuel oil (#2)	0	40 cents/l	0.53	1,591.24	467	1,124.03	0.00						
- fuel oil (#6)	0	20 cents/l	0.53	726.35	467	259.14	0.00						
	** Efficiency ratings are averages from the literature												
Energy Saving Conversion Customers				Multiply total residential conversions by % in cells above.									
Residential	Previous energy source for converting customers (%)	# of customers Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
- electricity	0%	0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil	87%	0	341	681	1,192	1,703	2,385	3,066	3,747	4,599	5,621	7,835	8,431
- propane	0%	0	0	0	0	0	0	0	0	0	0	0	0
- wood	12%	0	47	94	164	235	329	423	517	634	775	1,081	1,163
Commercial													
- electricity	38%	0	5	11	16	22	27	33	38	43	49	63	69
- fuel oil (#2)	62%	0	9	18	27	35	44	53	62	71	80	103	113
- fuel oil (#6)	0%	0	0	0	0	0	0	0	0	0	0	0	0
- propane	0%	0	0	0	0	0	0	0	0	0	0	0	0
- wood	0%	0	0	0	0	0	0	0	0	0	0	0	0
Small and Med Industrial													
- electricity	31%	0	1	2	5	7	9	10	10	11	11	13	14
- fuel oil (#2)	69%	0	2	6	11	17	20	22	23	24	25	29	31
- fuel oil (#6)	0%	0	0	0	0	0	0	0	0	0	0	0	0
- propane	0%	0	0	0	0	0	0	0	0	0	0	0	0
- wood	0%	0	0	0	0	0	0	0	0	0	0	0	0
Large Industrial													
- propane	20%	0	14	14	14	14	14	14	14	14	14	14	14
- fuel oil (#2)	20%	0	14	14	14	14	14	14	14	14	14	14	14
- fuel oil (#6)	60%	0	43	43	43	43	43	43	43	43	43	43	43
Very Large Industrial													
- propane	0%	0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#2)	15%	1	1	1	1	1	1	1	1	1	1	1	1
- fuel oil (#6)	85%	0	2	2	2	2	2	2	2	2	2	2	2
Energy Cost Savings by Customer Class (in cents, less taxes)			= (number of gas customers in that year) * (usage) * (incremental savings over other fuel)										
- electricity		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil		0	24,173,579	48,347,158	84,607,527	120,867,896	169,215,054	217,562,213	265,909,371	326,343,319	398,864,057	555,992,321	598,296,085
- propane		0	0	0	0	0	0	0	0	0	0	0	0
- wood		0	0	0	0	0	0	0	0	0	0	0	0
Commercial	subtotal (resid)	0	241,736	483,472	846,075	1,208,679	1,692,151	2,175,622	2,659,094	3,263,433	3,988,641	5,559,923	5,982,961
- electricity		0	2,172,248	4,344,496	6,516,744	8,688,992	10,861,240	13,033,487	15,205,735	17,377,983	19,550,231	25,198,076	27,804,773
- fuel oil (#2)		0	5,290,702	10,581,405	15,872,107	21,162,809	26,453,512	31,744,214	37,034,916	42,325,618	47,616,321	61,372,147	67,720,989
- fuel oil (#6)		0	0	0	0	0	0	0	0	0	0	0	0
- propane		0	0	0	0	0	0	0	0	0	0	0	0
- wood		0	0	0	0	0	0	0	0	0	0	0	0
Small and Med Industrial	subtotal (comm)		7,462,950	14,925,900	22,388,851	29,851,801	37,314,751	44,777,701	52,240,651	59,703,602	67,166,552	86,570,222	95,525,763
- electricity		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#2)		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#6)		0	0	0	0	0	0	0	0	0	0	0	0
- propane		0	0	0	0	0	0	0	0	0	0	0	0
- wood		0	0	0	0	0	0	0	0	0	0	0	0
Large Industrial	subtotal (small med industrial)		0	0	0	0	0	0	0	0	0	0	0
- propane		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#2)		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#6)		0	0	0	0	0	0	0	0	0	0	0	0
Very Large Industrial	subtotal (lrg industrial)		0	0	0	0	0	0	0	0	0	0	0
- propane		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#2)		0	0	0	0	0	0	0	0	0	0	0	0
- fuel oil (#6)		0	0	0	0	0	0	0	0	0	0	0	0
Total (cents)		0	28,472,876	56,945,753	96,296,740	135,647,727	185,876,825	236,105,923	286,335,020	347,442,229	419,427,548	578,306,289	624,439,663
Total (dollars)		0	$ 284,729	$ 569,458	$ 962,967	$ 1,356,477	$ 1,858,768	$ 2,361,059	$ 2,863,350	$ 3,474,422	$ 4,194,275	$ 5,783,063	6,244,397
	subtotal (XL Industrial)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cost of Converting													
Residential, Commercial and Indstrial consumers will have to pay to convert their existing hardware to													
accommodate natural gas. If their existing hardware is not at the end of its useful life, the consumer will be out-of-pocket													
an amount equal to the valued useful life remaining on old hardware. For this reason, we discount the annual													
cost savings to account for equipment replacements prior to the end of useful life.													
These factors are already reflected in the Total Energy Cost Savings by Customer Class calculations above.													
To lower the savings "leakage" attributable to conversion costs, increase the percentages below.													
		Net Savings Factors											
		Residential	90%										
		Commercial	90%										
		Industrial	80%										

Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 4 - Energy Demand

ENERGY DEMAND

Case Study Location	Population (1991)	Population (1996)	Population (2001)	Estimated total number of residential users
Province				
Area A				10000
Area B				13000
Area C				3000
Area D				3000
				29000 TOTAL # dwellings

Estimated Thermal Energy Demand by user class

	MMBtu	GJ
Residential		0
Commercial		0
Small / Medium Industrial		0
Large Industrial		0
Very Large Industrial	1,500,000	1,575,000
total	1,500,000	1,575,000

Figures here represent known energy consumption amounts for the study area. Consumption amounts can be estimated, as below, using averages and residential/commercial information if this is not known.

Forecast Take-up Rates by year

Year	Residential	Commercial	Small/Medium Industry	Large Industry
1	2%	5%	5%	100%
2	2%	5%	10%	
3	3%	5%	15%	
4	3%	5%	15%	
5	4%	5%	10%	
6	4%	5%	5%	
7	4%	5%	3%	
8	5%	5%	3%	
9	6%	5%	2%	
10	5%	5%	2%	
11	4%	2%	2%	
12	2%	2%	2%	
13	1%	2%	2%	
14	1%	2%	2%	
15	1%	2%	2%	
16	1%	1%	1%	
17	0.5%	1%	1%	
18	0.5%	1%	1%	
19	0.5%	1%	1%	
20	0.5%	1%	1%	
	50%	65%	85%	

THIS TABLE IS USED IN THE "BENEFITS" SHEET FOR ALL USER GROUPS

Total Demand in MMBtu	Very Large Industrial	Large Industrial	Small & Med Industrial	Commercial	Residential	Total Demand
Year 1	1,500,000	0	0	0	71,810	1,571,810
Year 2	1,500,000	0	0	0	143,619	1,643,619
Year 3	1,500,000	0	0	0	251,333	1,751,333
Year 4	1,500,000	0	0	0	359,048	1,859,048
Year 5	1,500,000	0	0	0	502,667	2,002,667
Year 6	1,500,000	0	0	0	646,286	2,146,286
Year 7	1,500,000	0	0	0	789,905	2,289,905
Year 8	1,500,000	0	0	0	969,429	2,469,429
Year 9	1,500,000	0	0	0	1,184,857	2,684,857
Year 10	1,500,000	0	0	0	1,364,381	2,864,381
Year 15	1,500,000	0	0	0	1,687,524	3,187,524
Year 20	1,500,000	0	0	0	1,795,238	3,295,238

TRANSPOSED TABLE ON LEFT (this table is linked to the Benefits sheet

Number of Users based on Above table	Number of Very Large Industrial Users (@ 763,632 GJ Each)	Number of Large Industrial Users @10,000 GJ Each	Number of Small and Medium Users (@ 5000 GJ each)	Number of Commercial Users (@ 1,650 GJ each)	Number of Residential Users (@130GJ Each)
Year 1	2	0	0	0	580
Year 2	2	0	0	0	1,160
Year 3	2	0	0	0	2,030
Year 4	2	0	0	0	2,900
Year 5	2	0	0	0	4,060
Year 6	2	0	0	0	5,220
Year 7	2	0	0	0	6,380
Year 8	2	0	0	0	7,830
Year 9	2	0	0	0	9,570
Year 10	2	0	0	0	11,020
Year 15	2	0	0	0	13,630
Year 20	2	0	0	0	14,500

Number of Users based on Above table	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 20
Number Agro-Food Industrial Users (@ 763,632 GJ Each	2	2	2	2	2	2	2
# Large Industrial Users @10,000 GJ Each	72	72	72	72	72	72	72
Number of Small and Medium Users (@ 5000 GJ each)	3	8	16	24	30	38	46
Number of Commercial Users (@ 1,650 GJ each)	14	29	43	57	71	143	186
Number of Residential Users (@130GJ Each)	445	890	1557	2225	3115	8454	11124

Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 5 - Financial and Economic Analysis

Calculation of Benefits - Costs

Sensitivity Factors												
Gas Sales	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Net Energy Costs Savings	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
- Capital	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
- Operating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Discount Rate	**Cost of Gas**	$/MMBtu	$/GJ
5.0%		4.55	4.33
7.5%	Source: BC Gas; Energyshop.com		
10.0%			

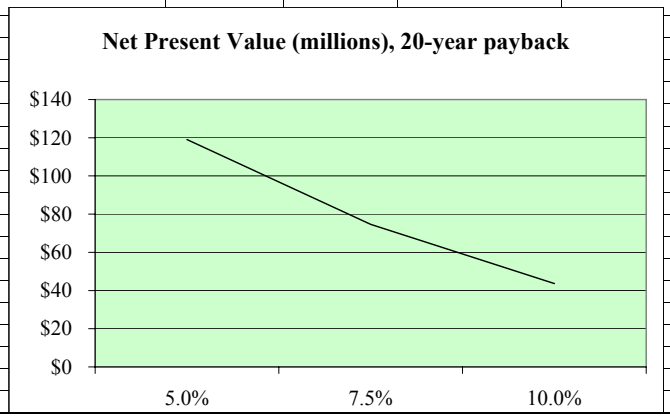
This cell reflects the current commodity price of gas, i.e. the price that is paid for gas, not including lateral and distribution tolls.

Financial or CBA depending on Test

Revenue	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 15**	**Year 20**
Gas Sales	0	1,022,645	10,696,996	12,858,461	15,030,689	17,471,387	19,772,175	22,234,398	24,674,508	27,684,434	35,608,632	39,411,059
Total Saving	0	284,729	569,458	962,967	1,356,477	1,858,768	2,361,059	2,863,350	3,474,422	4,194,275	5,783,063	6,244,397
Total Revenue	0	1,307,374	11,266,453	13,821,429	16,387,166	19,330,155	22,133,234	25,097,748	28,148,930	31,878,710	41,391,695	44,936,805
Cost												
Costs												
Cost of Gas ($4.55/MMBtu)	0	380,959	4,477,847	5,401,933	6,330,570	7,259,655	8,071,350	8,927,999	9,720,487	10,687,416	13,441,450	14,927,049
- Capital	59,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000				
- Operating	391,100	687,100	753,100	898,100	939,100	1,043,100	1,172,100	1,226,100	1,252,100	1,340,100	1,738,100	1,965,100
Total Cost	59,391,100	4,068,059	8,230,947	9,300,033	10,269,670	11,302,755	12,243,450	13,154,099	10,972,587	12,027,516	15,179,550	16,555,757
Net Revenue (dollars)	-59,391,100	-2,760,685	3,035,506	4,521,395	6,117,496	8,027,400	9,889,784	11,943,649	17,176,343	19,851,194	26,212,145	28,381,048

Discount Rate	Net Present Value (millions)		Test: CBA=1,Financial=0	
5.0%	$119			1
7.5%	$75			
10.0%	$44			

	Increase by 20%	Decrease by 20%
Capital Cost	66	86
Operating Costs	74	78
Energy Savings	82	70

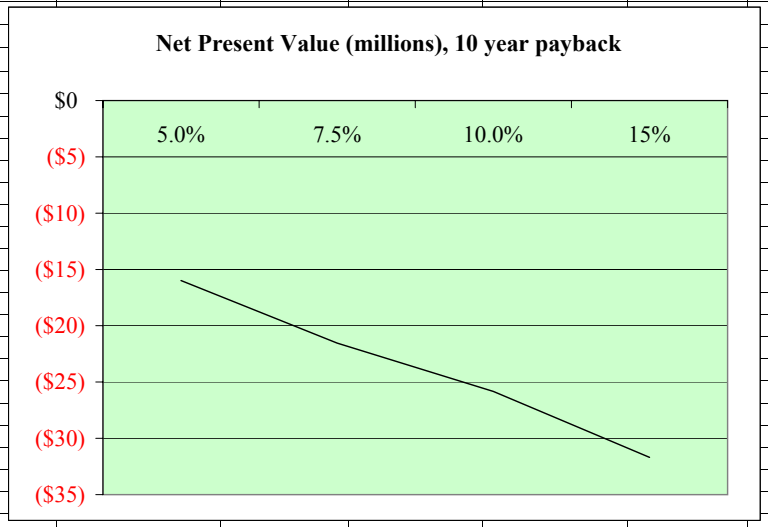


Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 5 - Financial and Economic Analysis

ALWAYS FINANCIAL, 10-Year Payback Period

Revenue	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20
Gas Sales	-	1,022,645	10,696,996	12,858,461	15,030,689	17,471,387	19,772,175	22,234,398	24,674,508	27,684,434	35,608,632	38,760,232
												-
Total Revenue	-	1,022,645	10,696,996	12,858,461	15,030,689	17,471,387	19,772,175	22,234,398	24,674,508	27,684,434	35,608,632	38,760,232
												-
												-
Cost												-
Costs												-
Cost of Gas ($4.55/MMBtu)	-	380,959	4,477,847	5,401,933	6,330,570	7,259,655	8,071,350	8,927,999	9,720,487	10,687,416	13,441,450	14,667,657
- Capital	59,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	-	-	-	-
- Operating	391,100	687,100	753,100	898,100	939,100	1,043,100	1,172,100	1,226,100	1,252,100	1,340,100	1,738,100	1,888,100
Total Cost	59,391,100	4,068,059	8,230,947	9,300,033	10,269,670	11,302,755	12,243,450	13,154,099	10,972,587	12,027,516	15,179,550	16,555,757
												-
Net Revenue (dollars)	-59,391,100	-3,045,414	2,466,049	3,558,428	4,761,019	6,168,632	7,528,725	9,080,299	13,701,921	15,656,919	20,429,082	22,204,475

Discount Rate	Value (millions)
5.0%	($16)
7.5%	($22)
10.0%	($26)
15%	($32)



Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 6 - Oil and Gas Prices

Greenfield Market Petroleum Product Prices, 2000-2020 (2000 $CDN)

				Fuel Oil #2												Residual #6	
	Crude Oil	Crude Oil	Crude Oil	Residential			Commercial			Industrial			Commercial			Indu	
Year	$US/bbl	$CDN/bbl	$CDN/l	$/l	$/GJ	$/MMBtu	$/l	$/GJ	$/MMBtu	$/l	$/GJ	$/MMBtu	$/l	$/GJ	$/MMBtu	$	
2000	27.72	44.07	0.28	0.69	17.86	18.75	0.46	11.93	12.53	0.46	11.93	12.53	0.26	6.20	6.51	0	
2005	22.73	36.14	0.23	0.57	14.65	15.38	0.38	9.78	10.27	0.38	9.78	10.27	0.22	5.08	5.33	0	
2010	23.36	37.14	0.23	0.58	15.05	15.80	0.39	10.05	10.56	0.39	10.05	10.56	0.22	5.22	5.48	0	
2015	24.00	38.16	0.24	0.60	15.46	16.24	0.40	10.33	10.85	0.40	10.33	10.85	0.23	5.36	5.63	0	
2020	24.68	39.24	0.25	0.62	15.90	16.70	0.41	10.62	11.15	0.41	10.62	11.15	0.23	5.52	5.79	0	

Source: US Energy Information Administration, Annual Energy Outlook 2002

Exchange Rate $1 US = $ 1.59 Cdn

(Assuming Crude @ 24.00/bbl US = $38.16/bbl CDN)

Crude Oil	Crude Oil	Residential #2	Residential Gas	Commercial #2	Commercial Gas	Industrial #6	Industrial Gas
$US/bbl	$CDN/bbl	$/MMBtu	$/MMBtu	$/MMBtu	$/MMBtu	$/MMBtu	$/MMBtu
24.00	38.16	16.24	14.61	10.85	9.76	5.04	4.54
		0.60	per litre	0.40	per litre	0.20	per litre
$/GJ			15.34		10.25		4.76

** This page is used to approximate the cost of furnace fuel, and #6 fuel oil, based on the current price of crude (in $USD).
In this case, $24.00 US per barrel was the approximate long-term price, which coincided with a forecast price for 2015.
This sheet also assumes natural gas is priced competitively with #2 fuel oil and #6 fuel oil (ten percent cheaper, in this case.)

Changing this value will change the approximate price of furnace oil and #6, and give the corresponding "10% less" price of natural gas.

Greenfield Gas Project, Phase III
Cost-Benefit Analysis
Sheet 7 - Fuel Comparisons

** This worksheet records all the current (or study-based) fuel prices, and allows comparison in the Benefits sheet, based on price per unit of heat (MMBtu, in this case).

Statistics Canada Energy Conversion Factors (2000) (From Energy Statistics Handbook)

Fuel Type	Unit	terajoules/unit	MMBtu/Unit	BTUs/Unit		MMBtu/litre or kWh
Propane	megalitre	25.31	24.1047619	24,105	(litre)	0.024105
light fuel oil	megalitre	38.8	36.95238095	36,952	(litre)	0.036952
heavy fuel oil	megalitre	42.5	40.47619048	40,476	(litre)	0.040476
natural gas	gigalitre	37.99	36.18095238	36,181	(litre)	0.036181
electricity	kwh	3.6	3.78	3,780		0.003780

Units Used in this Study (Heat Content by Fuel)**

fuel	unit	BTU/unit	MMBtu/Unit
Natural Gas	litre	36,181	0.03618095
Natural Gas	cubic metre	35,300	0.03530000
Electricity	kWh	3,413	0.00341296
Light Fuel Oil	litre	36,952	0.03695238
Heavy Fuel Oil	litre	40,476	0.04047619
propane	litre	24,105	0.02410476
wood	cord	25,000,000	25.00000000

For reference use only

Prices used in this Spreadsheet

fuel	price	price per MMBtu	Efficiency	Efficiency Adjusted	Information Citation: year	Information Citation: source
electricity	8.46c/kWh	2478.78	0.99	2503.57		
electricity (small industrial)	4.82 c/ kWh	1104.61	0.99	1115.66		
light fuel oil	60 c / litre	1623.71	0.72	2078.35		
heavy fuel oil	20 c / litre	494.12	0.79	597.88		
propane	65.22 c/ litre	2705.69	0.76	3355.05		
wood	12200 c/ cord ($122.00/cord	488	0.45	756.40		