

Hydrocarbon and By-Product Reserves in British Columbia

December 31, 2008



British Columbia Cataloguing in Publication Data

Main entry under title:

Hydrocarbon and By-Product Reserves in British Columbia—1970-Annual.

Issuing body varies: 1972, Petroleum and Natural Gas Branch; 1973-1980, Petroleum Resources Branch; 1981-1986, Petroleum Resources Division; 1987-1994, Energy Resources Division; 1995-2000, Energy and Minerals Division.

Oil and Gas Commission 2001-2007. ISSN 0703-6655 = Hydrocarbon and By-Product Reserves in British Columbia.

1. Petroleum Reserves - British Columbia - Statistics. 2. Natural gas - British Columbia - Reserves - Statistics. 3. Sulphur - Statistics. I. British Columbia. Petroleum and Natural Gas Branch. II. British Columbia. Petroleum Resources Branch. III. British Columbia. Petroleum Resources Division. IV. British Columbia. Energy Resources Division; V. British Columbia. Energy and Minerals Division. VI. Resource Conservation Branch, Oil and Gas Commission. VII. Resource Conservation Department, Oil And Gas Commission

TN873.C3B74 553.28'09711

For additional information on the content of this report, contact:

Glynis Farr
Engineering Division
Resource Conservation Department
Oil and Gas Commission
300, 398 Harbour Rd
Victoria, British Columbia V9A 0B7
PHONE: (250) 419-4427 FAX: (250) 419-4402
Glynis.Farr@gov.bc.ca
www.ogc.gov.bc.ca

TABLE OF CONTENTS

Summary	4
Discussion	
A. Oil Reserves	5
B. Gas Reserves	7
C. By-Product Reserves	8
D. Detailed Reserve and Pool Parameter Listings	10
E. Additional Information	10
Figures	
1. Historical Remaining Oil Reserves vs R/P Ratio	5
2. Historical Remaining Oil Reserves vs Annual Production	6
3. Oil Reserves – Reserve Additions per Well Drilled	6
4. Sour Gas (H ₂ S) Map of Northeast British Columbia	8
5. Historical Remaining Gas Reserves vs R/P Ratio	9
6. Historical Remaining Gas Reserves vs Annual Production	9
7. Gas Reserves – Reserve Additions per Well Drilled	10
8. Reserves by Geological Period	17
9. Unconnected Gas Reserves by Plant Area	26
Tables	
I Established Hydrocarbon Reserves (SI Units)	11
II Established Hydrocarbon Reserves (Imperial Units)	11
III Historical Record of Established Reserves	12
IV Established Oil Reserve Changes	15
V Established Raw Gas Reserve Changes	16
VI(a) Initial Recoverable Oil Reserves by Geological Period	18
VI(b) Initial Recoverable Raw Gas Reserves by Geological Period	20
VII Oil Pools Under Waterflood	24
VIII Oil Pools Under Gas Injection	25
IX Unconnected Gas Reserves by Plant Area	26
X Project/Unit Cross-Reference Listing	27
Definitions	28
Appendices	
A. Oil Reserves and Basic Data	Green
B. Gas Reserves and Basic Data	Red
C. Raw Gas Analyses by Field/Pool	Blue
D. Remaining Hydrocarbon By-Products	Yellow

SUMMARY

This report presents estimates of British Columbia's oil, natural gas and associated by-product reserves as of December 31, 2008. The estimates have been prepared by the Oil and Gas Commission utilizing the most currently available geologic and reservoir interpretations. The reserve estimates represent established reserves and are based on accepted geological and engineering practices.

British Columbia's Remaining Established Reserves as of December 31, 2008, together with a comparison of the December 31, 2007 reserves, are summarized below.

Remaining Established Reserves

		2007	2008
OIL		19.7 10 ⁶ m ³ (123.9 MMSTB)	18.5 10 ⁶ m ³ (116.3 MMSTB)
GAS	Total, raw	482.9 10 ⁹ m ³ (17.1 TCF)	605.3 10 ⁹ m ³ (21.5 TCF)
	Total, marketable	394.2 10 ⁹ m ³ (14.0 TCF)	496.6 10 ⁹ m ³ (17.6 TCF)
	Unconnected Gas		
	Raw	26.9 10 ⁹ m ³ (0.953 TCF)	19.2 10 ⁹ m ³ (0.680 TCF)
	Marketable	21.4 10 ⁹ m ³ (0.758 TCF)	14.8 10 ⁹ m ³ (0.525 TCF)
BY-PRODUCTS	LPG	18.7 10 ⁶ m ³ (117.8 MMSTB)	25.2 10 ⁶ m ³ (158.7MMSTB)
	Pentanes+	7.4 10 ⁶ m ³ (46.7 MMSTB)	9.8 10 ⁶ m ³ (61.7 MMSTB)
	Sulphur	15.0 10 ⁶ tonnes (14.8MMLT)	14.1 10 ⁶ tonnes (13.9MMLT)

A. Oil Reserves

The Province's oil production for the 2008 calendar year was $1\,341\,10^3\text{m}^3$, 11.8% less than the production volume for the previous year marking the eighth year in a row of flat or decreasing annual production. Thirteen oil wells (Fig. 3) were drilled during 2008, a 69% decrease from the forty one wells drilled last year. This low number was the major cause for the remaining oil reserves at December 31, 2008 to decrease to $18.5\,10^6\text{m}^3$ from $19.7\,10^6\text{m}^3$ in 2007.

A decrease in oil production saw the remaining reserves to production ratio (R/P ratio), increase slightly from 12.9 years in 2007 to 13.8 years in 2008 (Figures 1 and 2).

The net reserve changes to oil due to revisions was so slight as to not cause a great change in the overall remaining oil reserves. The largest positive revision of $257\,10^3\text{m}^3$ resulted from a performance review of the Halfway oil pool in Peejay West that had a reserves to production ratio of less than one.

Drilling activity aimed at the discovery of new oil pools, added minimal reserves ($IR = 162.0\,10^3\text{m}^3$) down from the previous year's bookings of $266.0\,10^3\text{m}^3$. Drilling activity resulted in only 4 new pools being discovered, all of which were single well pools with small in place oil. The focus of drilling remained on Triassic sediments in the Fort St John area.

2008's decrease in oil drilling dropped the reserves added per well drilled value to $14.0\,10^3\text{m}^3$ (Figure 3). The major change to the 2008 oil reserves took place with the reduction in the recovery factor from 20% down to 7.5% within the Elm Gething A pool.

British Columbia's oil fields continue to be dominated by secondary recovery schemes. Waterflood pools account for approximately 49 percent of remaining oil reserves (Table VII) with Hay River and Boundary Lake being the dominant contributors.

Gas injection is currently occurring in three pools (Table VIII) and contributes about one percent to the provincial remaining reserves.

Figure 1: Historical Remaining Oil Reserves Versus R/P Ratio

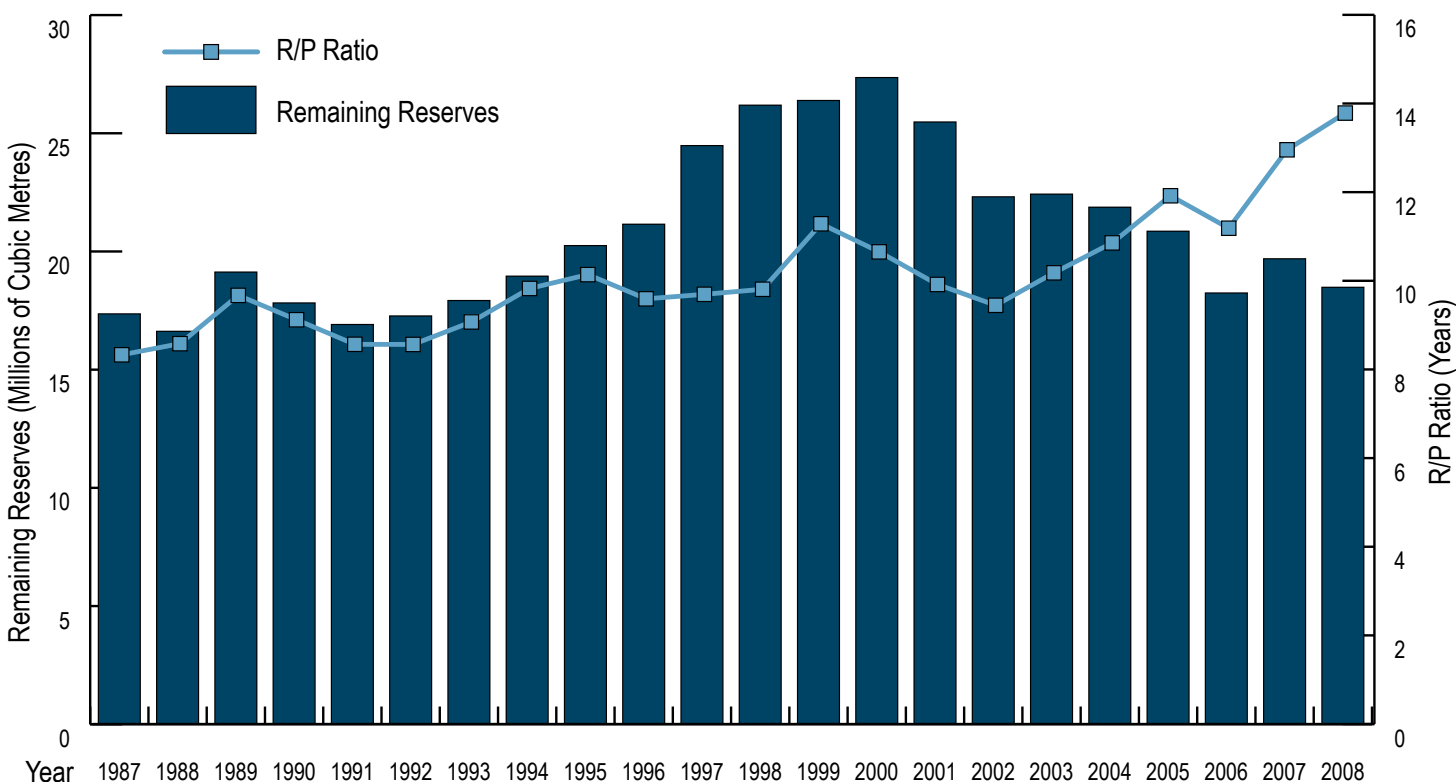


Figure 2: Historical Remaining Oil Reserves Versus Annual Production

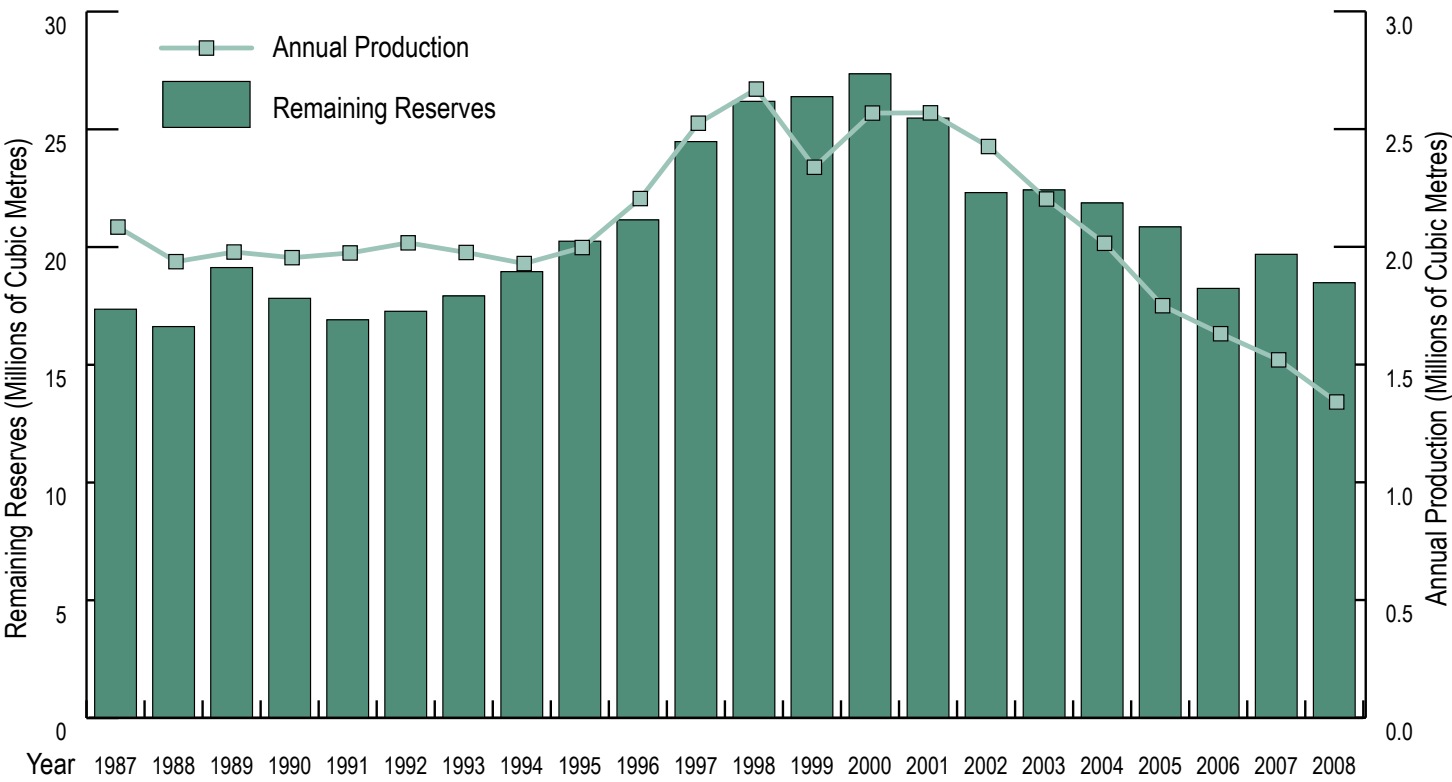
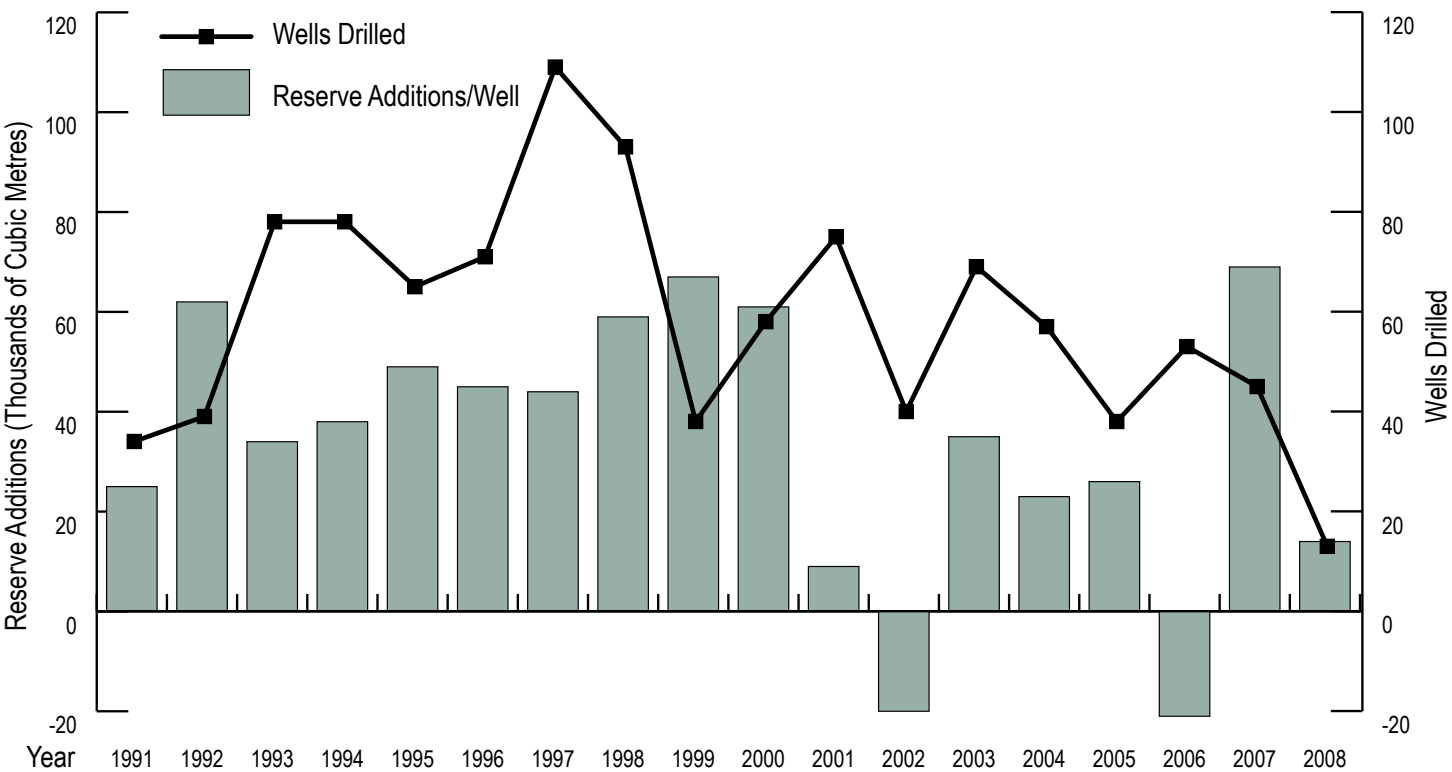


Figure 3: Oil Reserves - Reserve Additions Per Well Drilled



B. Gas Reserves

The Province's established remaining reserves of raw natural gas were $605.3 \times 10^9 \text{ m}^3$ as at December 31, 2008. For the eighth year in a row these figures represent the highest level of established gas reserves in the province's history. The 2008 year-end raw gas reserves represent a 25% increase over the 2007 year-end reserves.

Raw natural gas production for the year, as reported in this publication, was $30.3 \times 10^6 \text{ m}^3$, a slight increase over the preceding year's published production. The raw gas production for the year 2008 as reported by the Mineral, Oil and Gas Revenue Branch of the Ministry of Finance was $33.5 \times 10^6 \text{ m}^3$, representing a slight increase over last year's reported production. The discrepancy in reported raw gas production between agencies is due to the fact that the Commission only reports raw natural gas production for wells associated with gas pools that have been assigned established reserves. Due to industry application activity during 2007 and 2008 the provincial natural gas production and reserves are understated by approximately 9%.

The industry's exploration and development activities in British Columbia added $156.7 \times 10^6 \text{ m}^3$ of raw gas reserves. The slight production increase along with a significant increase in reserves resulted in an appreciable change in the reserves to production (R/P) ratio, increasing from 16.4 in 2007 to 20.0 in 2008 (Fig.5, 6). The Montney tight gas play is regarded as one of the most prospective unconventional gas plays in Canada/North America. In the past, the thick, regionally gas charged Montney formation was overlooked due to its low permeability. Technology improvements such as long reach horizontal wells and multi-stage horizontal "mega-frac" stimulations have begun to unlock the immense resource potential.

The regional Heritage – Montney A gas pool includes both the Upper and Lower Montney intervals and covers a large area. Geological mapping of the pool resulted in the amalgamation of Montney wells from the Swan Lake, Dawson Creek, Sunrise, Sundown, Sunset Prairie, Parkland and Groundbirch fields. The boundary of the pool is under revision as more and more wells drilled to the north and west are assigned to the Montney A pool.

Eighty five percent (85%) of remaining raw gas reserve additions were due to exploration and development activity in the regional Heritage – Montney A gas pool. The original gas in place for the Heritage – Montney A pool was calculated volumetrically incorporating an uncertainty factor for undeveloped lands surrounding this area. This review added $132.9 \times 10^6 \text{ m}^3$ raw gas reserves to our provincial total.

The Horn River Basin is another emerging unconventional gas play which gained momentum in 2008. Comparisons to the successful Barnett shales in Fort Worth, Texas and a shift in industry towards unconventional gas plays sparked record land sales in BC. Numerous experimental schemes have been granted by the Commission to evaluate the shale gas potential of the Muskwa and Horn River Formation shales (Otter Park, and Evie).

The 2008 drilling of new wells added a total of $6.8 \times 10^6 \text{ m}^3$ of initial reserves to the overall provincial total. This total includes reserves from wells that were rig released prior to 2008.

Continued extensional drilling to the south of the Gunnell Creek Jean Marie trend resulted in the addition of $4.1 \times 10^6 \text{ m}^3$ of initial recoverable reserves. This was partially due to the amalgamation of Sahtaneh's Jean Marie A, B, and C pools into the larger Gunnell Creek Jean Marie A pool. Although the number of horizontal wells drilled in the Greater Sierra Jean Marie trend was lower in 2008 than in previous years, the Commission predicts a return to historical activity levels in the area as commodity prices strengthen.

The Maxhamish Lake Chinkeh A gas cap revision added $6.9 \times 10^6 \text{ m}^3$ of initial recoverable reserves.

Recoverable reserve additions per new well increased to $345.0 \times 10^6 \text{ m}^3$ from $85.0 \times 10^6 \text{ m}^3$ in 2007. Figure 7 provides a historical perspective on the reserves findings.

DISCUSSION

C. By-Products

Established remaining reserves of liquefied petroleum gases (LPG) increased for the third year to $25.2 \times 10^6 \text{ m}^3$, as compared to $18.7 \times 10^6 \text{ m}^3$ at year-end 2007. Established remaining reserves of pentanes plus (C5+) increased to $9.8 \times 10^6 \text{ m}^3$ from $7.4 \times 10^6 \text{ m}^3$. Established remaining reserves of sulphur decreased slightly to $14.1 \times 10^6 \text{ t}$ from $15.0 \times 10^6 \text{ t}$ in 2007. Figure 4 shows the distribution of sour gas (H_2S %) throughout Northeast British Columbia.

For gas pools on production, the by-products reserves are estimated on the basis of the yield from raw gas reserves achieved at the plant to which the gas is delivered. For pools yet to be connected to a plant, the yields are estimated based on gas composition and capacity of the plant to which the pool is expected to be connected.

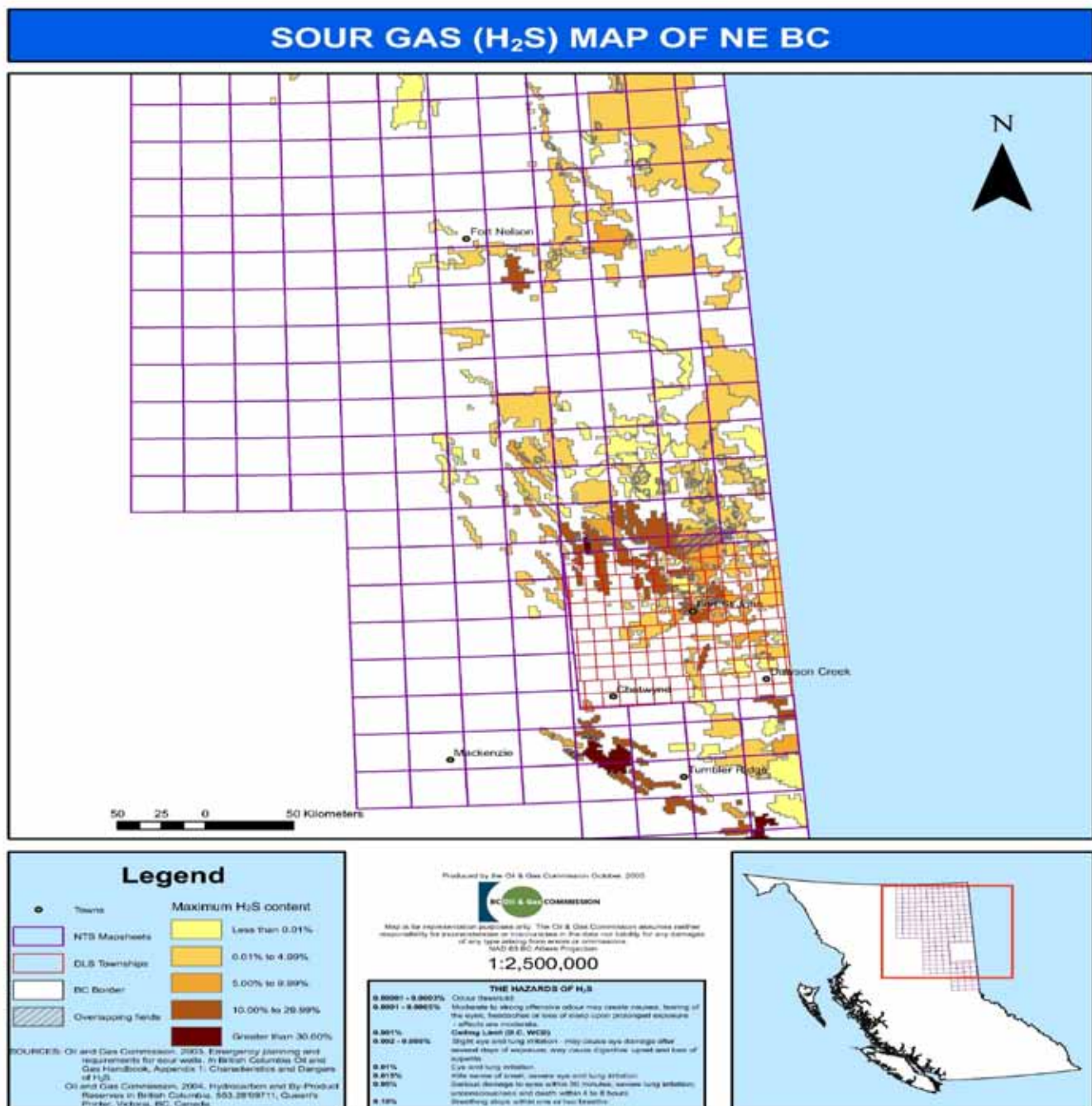


Figure 5: Historical Remaining Gas Reserves Versus R/P Ratio

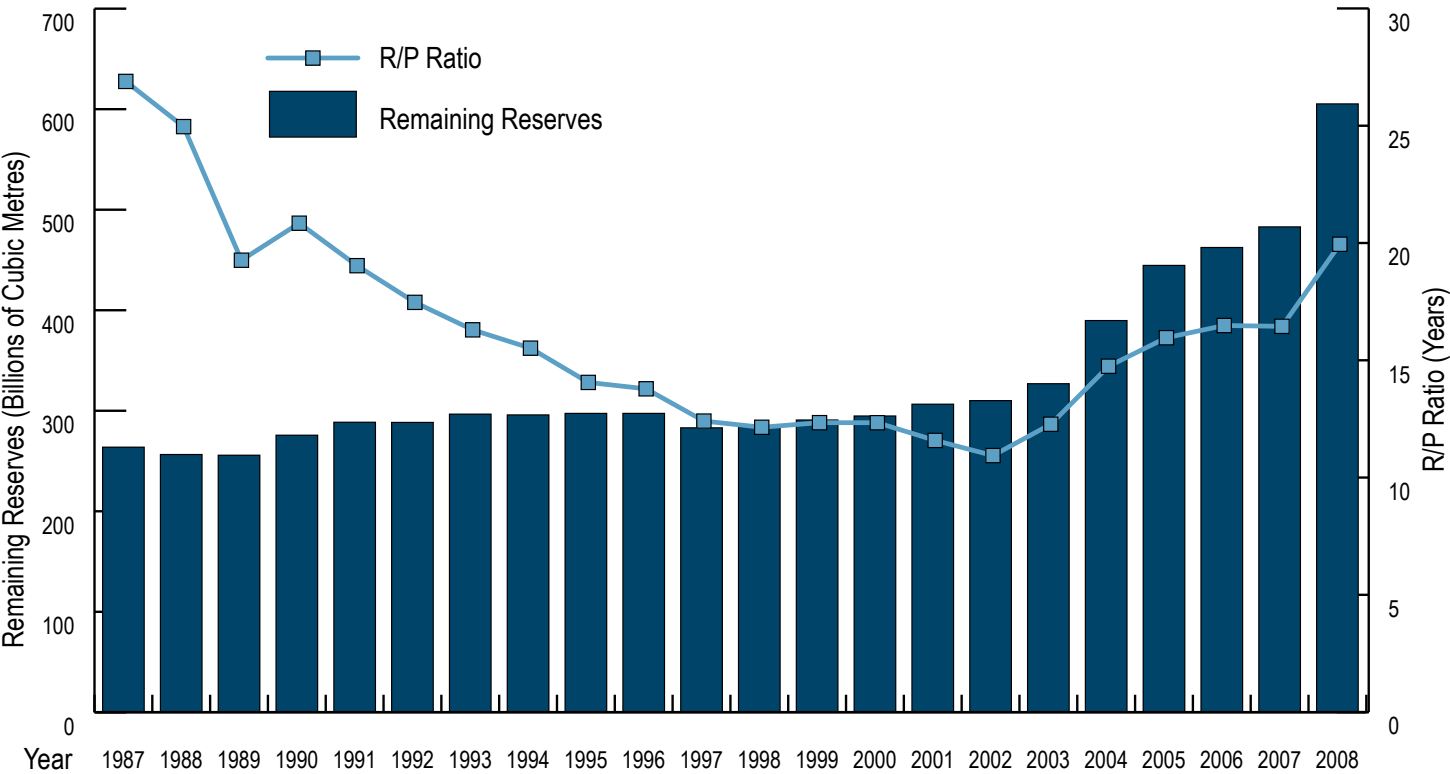


Figure 6: Historical Remaining Gas Reserves Versus Annual Production

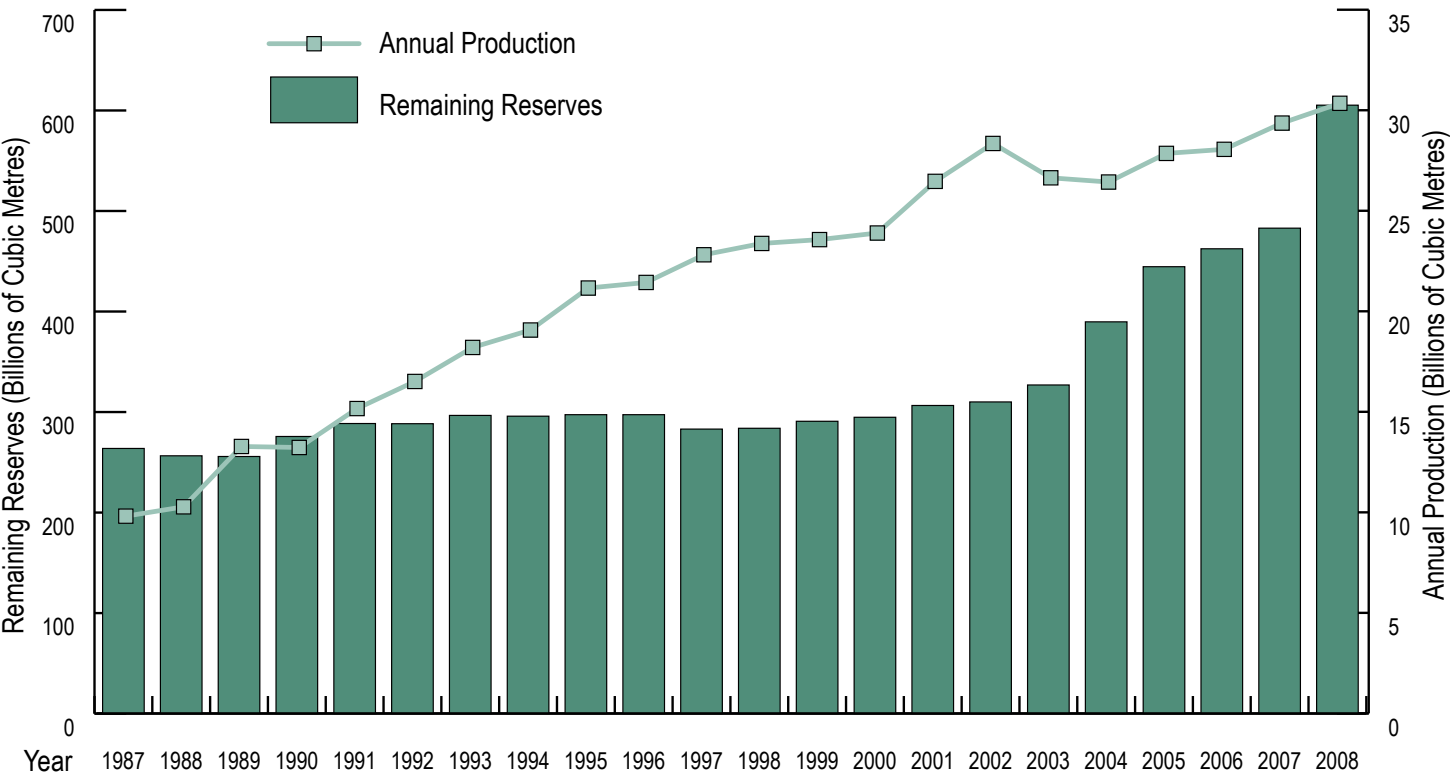
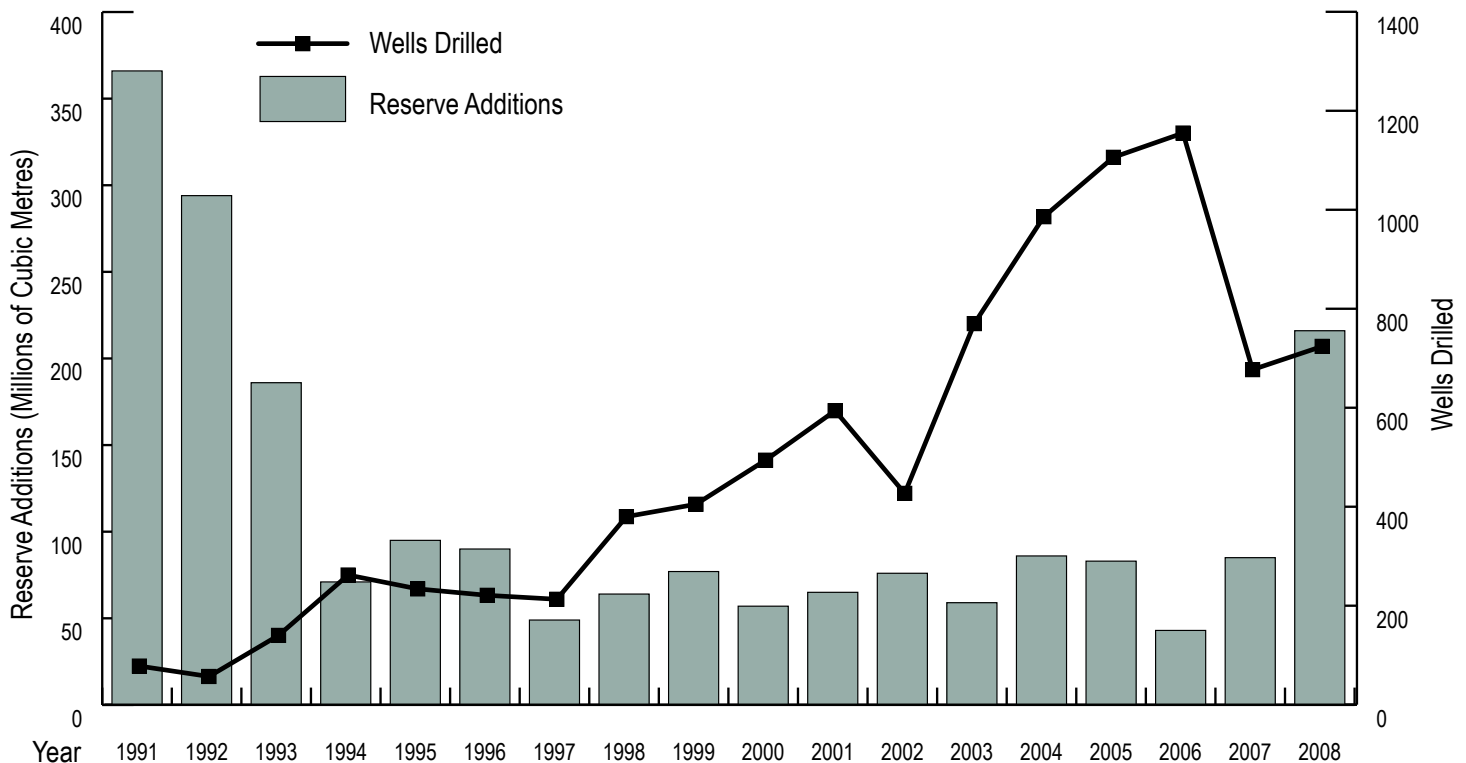


Figure 7: Gas Reserves - Reserve Additions Per Well Drilled



C. Detailed Reserve and Pool Parameter Listing

Included in this Report are detailed reserve and pool parameter listings which may be summarized as follows:

- Appendix A: Oil Reserves and Basic Data
- Appendix B: Gas Reserves and Basic Data
- Appendix C: Raw Gas Analyses
- Appendix D: Remaining Hydrocarbon By-Products

The Hydrocarbon and By-Product Reserves in British Columbia statistical information will continue to be offered to industry through the Internet at <http://www.ogc.gov.bc.ca/resourceconservationapp.asp>. For details on content, contact Glynis Farr, Resource Conservation Section, Oil and Gas Commission at (250) 419-4427 or email Glynis.Farr@gov.bc.ca.

D. Additional Information

A companion report to this publication would be the *British Columbia Oil & Gas Exploration Activity Report 2007-2008* compiled by the Oil and Gas Division, Resource Development and Geoscience Branch of the Ministry of Energy Mines and Petroleum Resources. For details please contact Chris Adams at (250) 953-3763 or email Christopher.Adams@gov.bc.ca.

R.Slocumb, P.Eng., Supervisor, Reservoir Engineering
Engineering Division, Resource Conservation Department, Oil and Gas Commission

ESTABLISHED HYDROCARBON RESERVES

December 31, 2008 (SI Units) Table I

	Oil ¹ (10 ³ m ³)	Raw Gas ¹ (10 ⁶ m ³)	Marketable Gas ² (10 ⁶ m ³)
Initial Reserves, Current Estimate	129,117	1,328,729	1,071,000
Drilling 2008	+162	+6,559	
Revisions 2008	+25	+150,167	
Production 2008	-1,341	-30,346	
Cumulative Production Dec. 31, 2008	-110,632	-722,769	-573,296
Remaining Reserves Estimate Dec. 31, 2008	18,485	605,280	496,622

¹ Crude Oil and Raw Gas figures are taken from current and previous Hydrocarbon Reserves Reports. Any discrepancies in balancing are attributed to system rounding and production history reconciliation.

² Marketable Gas figures are estimates of gas available to the transmission line after removal of acid gases and a percentage of liquid hydrocarbons.

NOTE: Gas volumes measured at 101.325 kPa and 15°C.

Actual plant and refinery recoveries of propane, butanes, pentanes+, and sulphur for 2008 were 484 10³m³, 321 10³m³, 406 10³m³, and 752 10³t, respectively.

December 31, 2008 (Imperial Units) Table II

	Oil ¹ (MSTB)	Raw Gas ¹ (BCF)	Marketable Gas ² (BCF)
Initial Reserves, Current Estimate	812,520	47,162	38,014
Drilling 2008	+1,019	+233	
Revisions 2008	+157	+5,530	
Production 2008	-8,439	-1,077	
Cumulative Production Dec. 31, 2008	-696,196	-25,654	-20,348
Remaining Reserves Estimate Dec. 31, 2008	116,324	21,484	17,627

¹ Crude Oil and Raw Gas figures are taken from current and previous Hydrocarbon Reserves Reports. Any discrepancies in balancing are attributed to system rounding and production history reconciliation.

² Marketable Gas figures are estimates of gas available to the transmission line after removal of acid gases and a percentage of liquid hydrocarbons. Oil figures are in units of thousands of stock tank barrels (MSTB) and gas figures are in billions of cubic feet (BCF).

Marketable Gas figures will no longer be recorded for changes taking place during the year due to the numerous shrinkage factors involved.

NOTE: Gas volumes measured at 14.65 psi and 60°F.

Actual plant and refinery recoveries of propane, butanes, pentanes+, and sulphur for 2008 were 2018 MSTB, 2018 MSTB, 2557 MSTB, and 741 MLT, respectively.

1. OIL RESERVES

Historical Record of Established Reserves¹ (10³m³)

Table III

Year	Initial Reserve Current Estimate	Yearly Drilling	Yearly Revisions	Yearly Other	Production in Year	Cumulative Production at Year-End	Remaining Reserves at Year-End
1977	72,841	4,159	(84)		2,201	46,318	26,523
1978	77,826	2,650	2,376		2,004	48,280	29,546
1979	78,882	427	629		2,140	50,397	28,485
1980	80,043	234	927		2,002	52,399	27,644
1981	79,968	143	(218)		2,060	54,459	25,509
1982	80,760	126	666		2,095	56,554	24,206
1983	82,149	661	727		2,079	58,634	23,515
1984	79,551	781	(3,378)		2,113	60,747	18,805
1985	82,887	1,767	1,569		1,944	62,691	20,196
1986	83,501	456	144		2,010	64,701	18,786
1987	84,201	631	68		2,084	66,793	17,361
1988	85,839	1,238	(50)		1,937	68,759	16,623
1989	89,899	2306	2,402		1,978	70,737	19,129
1990	90,650	569	181		1,954	72,714	17,823
1991	91,606	233	630		1,974	74,689	16,911
1992	94,030	823	1,596		2,017	76,750	17,273
1993	96,663	803	1,830		1,976	78,726	17,925
1994	99,619	1,477	1,482		1,929	80,664	18,956
1995	102,823	2,887	290		1,997	82,658	20,167
1996	106,009	1,306	1,878		2,205	84,856	21,153
1997	110,765	3,199	1,561		2,525	87,401	23,364
1998	116,294	815	4,717		2,670	90,105	26,189
1999	118,840	345	2,201		2,338	92,453	26,388
2000	122,363	504	3,018		2,568	95,031	27,357
2001	123,048	106	582		2,569	97,591	25,478
2002	122,245	427	(1233)		2,426	99,977	22,313
2003	124,660	424	1,990		2,203	102,234	22,426
2004	125,953	154	947	188	2,015	104,104	21,873
2005	126,941	247	636	110	1,750	106,086	20,857
2006	125,845	222	(1322)		1631	107,603	18,244
2007	128,971	266	2859		1,520	109,283	19,692
2008	129,117	162	25		1,341	110,632	18,485

¹ These values are taken from previously published ministry reserve estimates. This compilation is provided for historical value and to aid in statistical analysis only. Values shown for any given year may not balance due to changes in production and estimates over time.

2. RAW GAS RESERVES

Historical Record of Established Reserves¹ (10⁶m³)

Table III

Year	Initial Reserve Current Estimate	Yearly Drilling	Yearly Revisions	Yearly Other	Production in Year	Cumulative Production at Year-End	Remaining Reserves at Year-End
1977	376,960	18,119	(14,107)		11,039	143,958	233,002
1978	399,535	21,190	1,386		9,943	153,900	245,635
1979	424,805	26,142	(872)		11,394	165,294	259,511
1980	462,596	28,909	8,882		8,968	174,262	288,334
1981	478,689	13,842	2,251		8,293	182,555	296,134
1982	488,316	7,765	1,862		7,995	190,550	297,766
1983	490,733	2,550	(133)		7,845	198,395	292,338
1984	496,703	1,798	4,172		8,264	206,659	290,044
1985	505,233	2,707	5,823		8,799	215,458	289,775
1986	501,468	4,822	(8,463)		8,506	223,964	277,628
1987	497,466	1,986	(5,940)		9,810	233,794	263,777
1988	500,738	6,083	(1,661)		10,275	244,249	256,483
1989	513,662	12,193	(2)		13,276	257,862	255,782
1990	547,058	27,683	5,888		13,226	271,344	275,685
1991	574,575	24,708	3,812		15,162	285,965	288,582
1992	591,356	6,377	10,404		16,510	302,916	288,408
1993	617,379	22,901	3,122		18,202	321,090	296,246
1994	635,774	22,004	(3301)		19,069	339,861	295,885
1995	657,931	21,065	1,051		21,157	361,106	296,825
1996	677,769	16,083	3,852		21,435	382,332	295,437
1997	688,202	12,835	(2,394)		22,811	405,157	283,045
1998	712,677	9,957	14,502		23,375	428,822	283,855
1999	743,816	13,279	17,824		23,566	453,000	290,816
2000	772,221	13,832	14,571		23,894	477,381	294,800
2001	811,146	7,199	31,690		26,463	504,620	306,526
2002	843,612	19,004	13,462		28,348	533,548	310,064
2003	889,488	19,317	26,282		26,639	562,560	326,928
2004	973,771	6,412	65,149	12,897	26,430	584,033	389,738
2005	1,065,288	8,974	63,268	19,104	27,854	620,696	444,592
2006	1,114,562	15,356	33,912		28,056	652,137	462,425
2007	1,172,136	21,468	36,109		29,362	689,209	482,927
2008	1,328,729	6,559	150,167		30,346	722,769	605,280

¹ These values are taken from previously published ministry reserve estimates. This compilation is provided for historical value and to aid in statistical analysis only. Values shown for any given year may not balance due to changes in production and estimates over time.

3. MARKETABLE GAS RESERVES

Historical Record of Established Reserves¹ (10⁶m³)

Table III

Year	Initial Reserve Current Estimate	Cumulative Production at Year-End	Remaining Reserves at Year-End
1977	325,942	126,656	199,286
1978	326,322	126,149	200,173
1979	349,043	136,528	212,515
1980	378,729	143,863	234,866
1981	391,505	150,612	240,893
1982	399,838	157,139	242,699
1983	402,045	163,423	238,622
1984	406,812	170,079	236,773
1985	414,129	177,165	236,964
1986	411,126	184,145	227,029
1987	408,537	192,159	216,401
1988	411,481	201,035	210,831
1989	421,889	211,796	210,082
1990	454,839	224,417	230,398
1991	476,812	236,652	240,140
1992	490,101	250,924	239,175
1993	510,709	266,140	244,545
1994	527,008	282,709	244,283
1995	543,839	298,685	244,997
1996	557,864	315,057	242,807
1997	559,021	328,485	228,746
1998	573,848	344,764	229,084
1999	604,784	368,110	236,674
2000	626,935	386,689	240,210
2001	663,119	410,970	252,149
2002	690,225	435,363	254,889
2003	711,309	451,416	259,860
2004	784,063	466,698	317,365
2005	854,873	492,072	362,801
2006	899,215	519,139	380,076
2007	940,128	545,900	394,228
2008	1,071,000	573,296	496,622

¹ These values are taken from previously published ministry reserve estimates. This compilation is provided for historical value and to aid in statistical analysis only. Values shown for any given year may not balance due to changes in production and estimates over time.

ESTABLISHED OIL RESERVE CHANGES

Established Oil Reserve Changes (10^3m^3)
Table IV

Field	Pool	Amount of I.R. Change (10^3m^3)	Reason for Change
REVISION 2008			
Peejay West	Halfway A	+ 257	Performance review
Boundary Lake	Halfway_	+ 151	Performance review
Elm	Gething B	- 616	Performance review
	Others	- 233	
SUBTOTAL REVISIONS		+ 25	
DRILLING 2008			
Woodbrush	Halfway E	+ 92	New drilling
Osprey	Gething C	+ 50	New drilling
	*Others	+ 20	
SUBTOTAL DRILLING		+ 162	
TOTAL		+ 3125	

*Others – includes all additional changes both positive and negative

ESTABLISHED RAW GAS RESERVE CHANGES

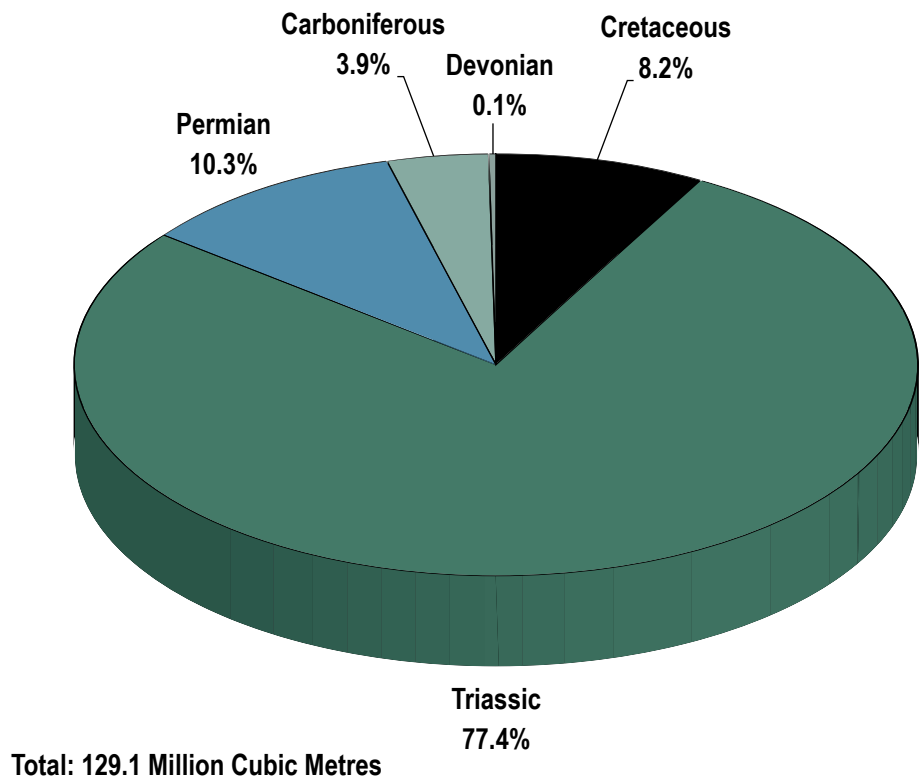
Established Raw Gas Reserve Changes (10^6m^3)
Table V

Field	Pool	Amount of I.R. Change (10^6m^3)	Reason for Change
REVISION 2008			
Regional Heritage	Montney A	+ 142,209	Mapping Revised
Beg	Halfway A	+ 7,840	Mapping Revised
Maxhamish Lake	Chinkeh A	+ 6,910	Mapping Revised
Gunnell Creek	Jean Marie A	+ 4,121	Mapping Revised
Brazion	Belcourt-Taylor Flat B	+ 3,591	Mapping Revised
Sierra	Jean Marie A	+ 2,790	Negative Reserves
Elleh	Jean Marie B	- 1,374	Performance Review
Red Creek North	Halfway A	- 370	Performance Review
Ladyfern	Slave Point C	- 274	Performance Review
	*Others	- 15,276	
SUBTOTAL REVISIONS		+ 150,167	
DRILLING 2008			
Septimus	Montney A	+ 1,598	New drilling
Caribou	Halfway A	+ 745	New drilling
Julienne Creek	Gething B	+ 445	New drilling
	*Others	+ 3,771	
**SUBTOTAL DRILLING		+ 6,559	
TOTAL		+ 156,726	

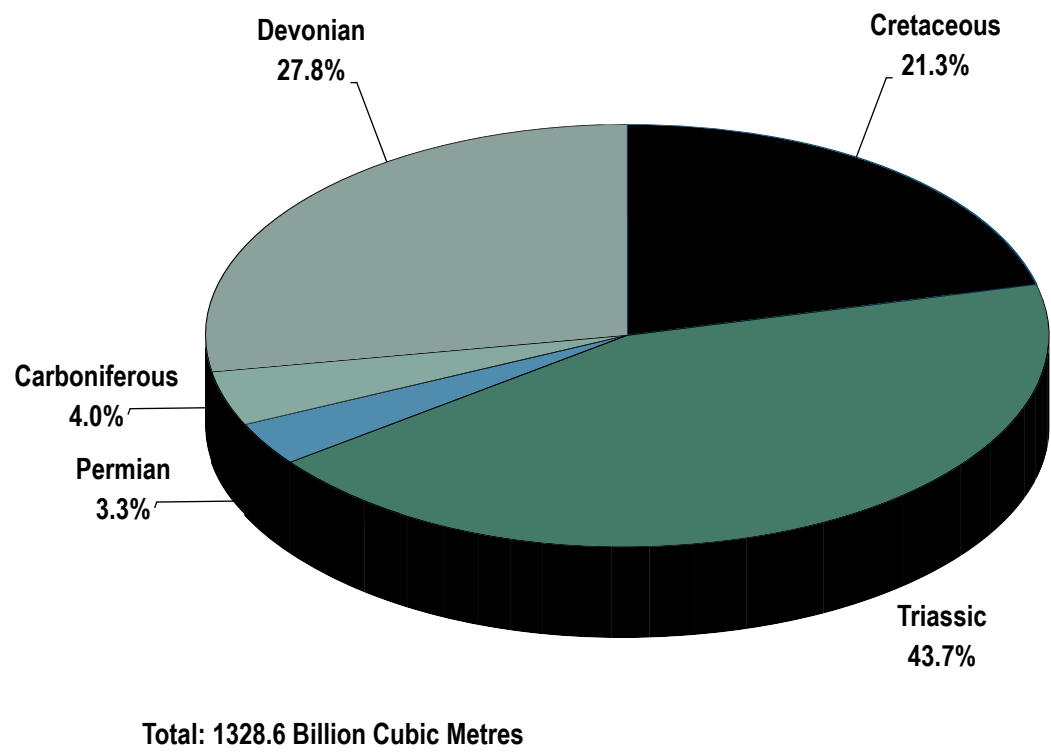
*Others - includes all additional changes both positive and negative

FIGURE 8 RESERVES BY GEOLOGICAL PERIOD

Initial Oil Reserves



Initial Raw Gas Reserves



Initial Recoverable Oil Reserves by Geological Period (10⁶m³)
Table VI(a)

CRETACEOUS	
Doe Creek	0.009
Bluesky	7.590
Bluesky/Gething	0.004
Gething	2.163
Cadomin	0.015
Dunlevy	0.715
Lower Dunlevy	0.047
SUBTOTAL	10.542

TRIASSIC	
Nordegg Baldonnel	0.019
Baldonnel	1.488
Charlie Lake	0.016
Siphon	0.414
Cecil	6.306
Flatrock	0.027
Boundary Lake	37.517
Coplin	0.282
Septimus	0.001
Mica	0.339
Blueberry	0.009
Inga	7.023
North Pine	1.656
Bear Flat	0.340
Wilder	0.003
Pingel	0.012
"A" Marker/Base of Lime	0.075
Artex	2.324
Halfway	35.186
Lower Halfway	4.510
Doig	2.285
Lower Charlie Lake/Montney	0.071
Montney	0.084
SUBTOTAL	99.986

Initial Recoverable Oil Reserves by Geological Period (10⁶m³)

Table VI(a)

PERMIAN	
Belloy	10.373
Belloy-Kiskatinaw	2.941
SUBTOTAL	13.314

CARBONIFEROUS	
Taylor Flat	0.038
Kiskatinaw	0.022
Debolt	4.039
Shunda	0.056
Pekisko	0.888
Banff	0.052
SUBTOTAL	5.095

DEVONIAN	
Jean Marie	0.161
SUBTOTAL	0.161
TOTAL	129.098

*Totals may not match Table III due to rounding

Initial Recoverable Raw Gas Reserves by Geological Period (10⁹m³)
Table VI(b)

CRETACEOUS	
Quaternary	0.015
Cardium Sand	0.037
Doe Creek	0.487
Dunvegan	0.199
Paddy	4.600
Cadotte	15.226
Peace River	1.646
Spirit River	0.028
Notikewin	25.593
Falher	0.359
Falher A	5.505
Falher B	3.776
Falher C	3.790
Falher D	0.695
Falher G	0.056
Bluesky	37.578
Basal Bluesky	1.416
Bluesky Gething	12.626
Bluesky - Gething - Detrital	1.485
Detrital	0.092
Gething	25.069
Lower Gething	0.319
Basal Gething	0.236
Gething Baldonnel	0.356
Cadomin	56.504
Chinkeh	6.910
Nikanassin	19.692
Dunlevy	58.165
Lower Dunlevy	0.145
Nordegg	0.116
SUBTOTAL	282.720

Initial Recoverable Raw Gas Reserves by Geological Period (10⁹m³)
Table VI(b)

TRIASSIC	
Nordegg/Baldonnel	1.899
Pardonet	0.496
Pardonet/Baldonnel	61.402
Baldonnel	90.649
Baldonnel/Upper Charlie Lake	58.419
Charlie Lake	3.127
Siphon	1.116
Cecil	3.327
Nancy	0.116
First Green Marker	0.017
Second Brown Marker	0.027
Boundary Lake	5.640
Basal Boundary	0.073
Yellow Marker	0.036
Coplin	2.938
Kobes	0.160
Blueberry	0.202
Inga	5.462
North Pine	4.533
Bear Flat	0.782
Pingel	0.097
Tea Creek Member	0.065
Trutch Creek	0.072
Limestone A Bed	0.052
"A" Marker/Base of Lime	1.638
Lower Charlie Lake Sands	0.178
Artex	2.314
Artex Halfway	0.913
Upper Halfway	0.489
Halfway	129.052
Lower Halfway	4.758
Doig	19.366
Doig Phosphate Beds	0.010
Bluesky/Gething/Montney	31.305
Lower Charlie Lake/Montney	3.335
Montney	146.013
SUBTOTAL	580.077

Initial Recoverable Raw Gas Reserves by Geological Period (10⁹m³) Table VI(b)

PERMIAN	
Belloy	32.652
Fantasque	0.111
Lower Belloy	0.680
Belcourt	0.390
Belcourt-Taylor Flat	9.019
Belloy/Kiskatinaw	0.949
SUBTOTAL	43.799

CARBONIFEROUS	
Taylor Flat	5.971
Mississippian	0.043
Mattson	2.478
Kiskatinaw	2.384
Lower Kiskatinaw	1.355
Basal Kiskatinaw	3.653
Golata	0.199
Upper Debolt	0.241
Debolt	34.662
Lower Debolt	0.143
Elkton	0.435
Shunda	0.918
Pekisko	0.037
Banff	0.391
SUBTOTAL	52.910

Initial Recoverable Raw Gas Reserves by Geological Period (10⁹m³) Table VI(b)

DEVONIAN	
Kotcho	0.279
Wabamun	8.355
Kakisa	1.184
Jean Marie	98.330
Horn River	0.247
Muskwa-Otter Park-Slave Point	0.010
Middle Devonian	0.061
Slave Point	122.066
Sulphur Point	2.222
Nahanni	5.484
Nahanni-Headless	0.125
Pine Point	130.772
SUBTOTAL	369.136
TOTAL	1328.642

*Totals may not match Table III due to rounding

Oil Pools Under Waterflood (10^3m^3)

Table VII

Field	Pool	Initial Reserves (10^3m^3)	Remaining Reserves (10^3m^3)
Beatton River	Halfway A	1,629	13
Beatton River	Halfway G	470	54
Beatton River West	Bluesky A (Unit 1)	943	17
Beavertail	Halfway B	91	6
Beavertail	Halfway H	157	4
Boundary Lake	Boundary A	36,316	1,736
Bubbles North	Coplin A	58	25
Buick Creek West	Dunlevy N	14	9
Crush	Halfway A + B	566	13
Currant	Halfway D (Unit 1)	24	16
Desan	Pekisko	784	254
Eagle	Belloy-Kiskatinaw	2,772	394
Eagle West	Belloy A (Unit 1)	6,569	430
Elm	Gething B	169	47
Hay River	Bluesky	6,207	3,281
Inga	Inga A (Unit 1, 2, 4, 5)	6,953	231
Lapp	Halfway C	457	45
Lapp	Halfway D	166	37
Milligan Creek	Halfway A (Unit 1, 2)	7,419	55
Muskrat	Boundary Lake A	401	155
Muskrat	Lower Halfway A	116	13
Oak	Cecil B	127	37
Oak	Cecil C	363	106
Oak	Cecil E	587	10
Oak	Cecil I	225	20
Owl	Cecil A	353	52
Peejay	Halfway (Unit 1, 2, 3 + CNRL)	10,579	193
Peejay West	Halfway A	525	136
Red Creek	Doig C	218	76
Rigel	Cecil B	576	32
Rigel	Cecil G	426	34
Rigel	Cecil H	910	75
Rigel	Cecil I	740	45
Rigel	Halfway C (Archean + Unit 1)	515	29

OIL POOLS UNDER WATERFLOOD

Oil Pools Under Waterflood (10^3m^3)
Table VII

Field	Pool	Initial Reserves (10^3m^3)	Remaining Reserves (10^3m^3)
Rigel	Halfway Z	21	14
Squirrel	North Pine C	487	80
Stoddart West	Bear Flat D	155	9
Stoddart West (partial)	Belloy C <small>(Anderson)</small>	1,446	151
Stoddart West	North Pine D	38	18
Sunset Prairie	Cecil A	353	26
Sunset Prairie	Cecil C	147	36
Sunset Prairie	Cecil D	152	51
Two Rivers	Siphon A	215	52
Weasel	Halfway <small>(Unit 1, 2)</small>	3,439	165
Wildmint	Halfway A <small>(Unit 1)</small>	1,554	20
TOTAL		96,951	8,302
% OF TOTAL BRITISH COLUMBIA RESERVES		75	45

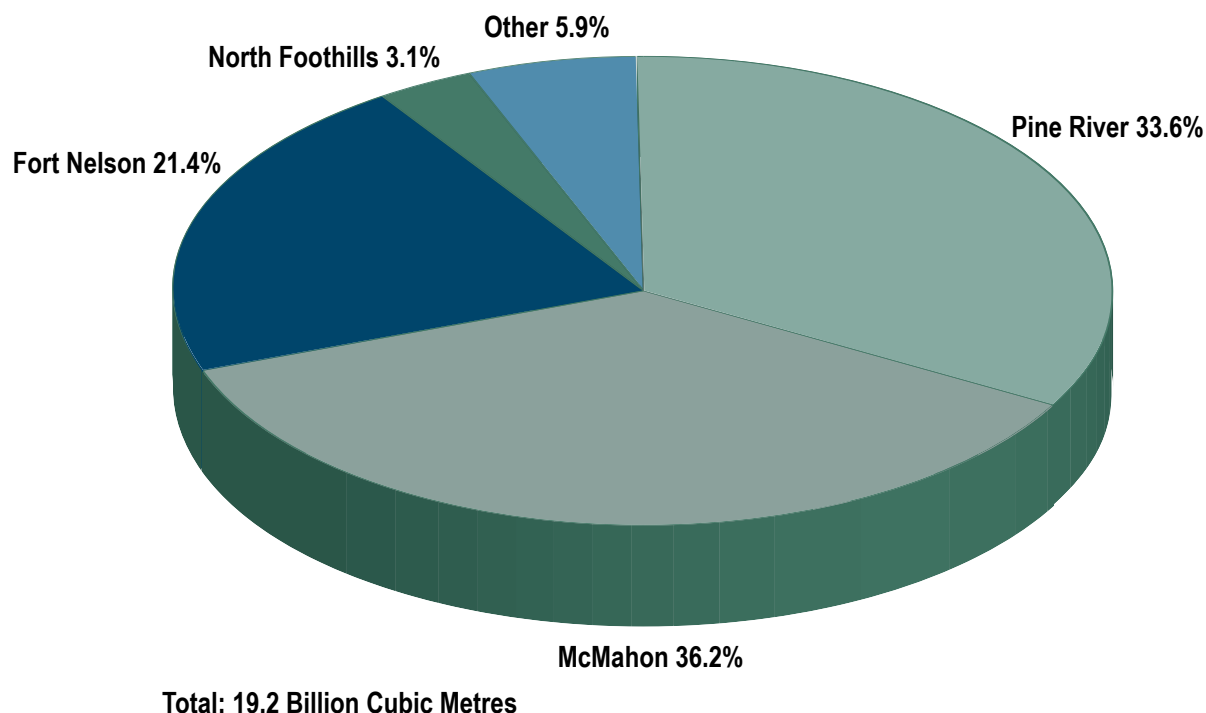
Oil Pools Under Gas Injection (10^3m^3)
Table VIII

Field	Pool	Initial Reserves (10^3m^3)	Remaining Reserves (10^3m^3)
Bulrush	Halfway A	369	67
Cecil Lake	Cecil D	308	12
Stoddart West (partial) ¹	Belloy C <small>(Phillips)</small>	425	57
TOTAL		1102	136
% OF TOTAL BRITISH COLUMBIA RESERVES		0.9	0.7

¹ This pool has implemented one gas-injection scheme (Phillips Project) in addition to the waterflood scheme (Anderson Project).

UNCONNECTED GAS RESERVES BY PLANT AREA

Figure 9: Unconnected Gas Reserves by Plant Area
Remaining Reserves (Raw)



Unconnected Gas Reserves by Plant Area (10^9m^3)
Table IX

Plant Name	Initial Remaining Raw Gas (10^9m^3)
¹ Pine River (c-85-D/93-P-12)	6.4
McMahon (5-31-82-17)	6.9
Fort Nelson (b-84-G/94-J-10)	4.1
² North Foothills	0.6
Other	1.2
TOTAL	19.2

* Totals may not add up due to rounding

¹ Includes BRC Elmworth (4-8-70-11-W6) and Burlington Noel (b-59-D/093-P-8).

² Includes WGSi Buckinghorse (a-81-H/094-G-6), Anadarko Cypress (b-99-C/094-B-16) and WEI Sikanni (b-41-I/094-G-3).

Table X

Project Type	Description
CONC	Concurrent Production
EOR	Enhanced Oil Recovery
GEPC	Good Engineering Practice - Gas
GEPO	Good Engineering Practice - Oil
PMGI	Pressure Maintenance - Gas Injection
PMWF	Pressure Maintenance - Water Flood
UNIT	Unitization

For a complete project/unit cross-reference listing visit http://www.ogc.gov.bc.ca/documents/annualreports/project_listing.pdf

Definitions: SI Units

British Columbia's reserves of oil, natural gas liquids and sulphur are presented in the International System of Units (SI). The provincial totals and a few other major totals are shown in both SI units and the Imperial equivalents in the various tables. Conversion factors used in calculating the Imperial equivalents are listed below:

1 cubic metre of gas (101.325 kilopascals and 15° Celsius)	=	35.493 73 cubic feet of gas (14.65 psia and 60° Fahrenheit)
1 cubic metre of ethane (equilibrium pressure and 15° Celsius)	=	6.330 0 Canadian barrels of ethane (equilibrium pressure and 60° Fahrenheit)
1 cubic metre of propane (equilibrium pressure and 15° Celsius)	=	6.300 0 Canadian barrels of propane (equilibrium pressure and 60° Fahrenheit)
1 cubic metre of butanes (equilibrium pressure and 15° Celsius)	=	6.296 8 Canadian barrels of butanes (equilibrium pressure and 60° Fahrenheit)
1 cubic metre of oil or pentanes plus (equilibrium pressure and 15° Celsius)	=	6.292 9 Canadian barrels of oil or pentanes plus (equilibrium pressure and 60° Fahrenheit)
1 cubic metre of water (equilibrium pressure and 15° Celsius)	=	6.290 1 Canadian barrels of water (equilibrium pressure and 60° Fahrenheit)
1 tonne	=	0.984 206 4 (U.K.) long tons (2240 pounds)
1 tonne	=	1.102 311 short tons (2000 pounds)
1 kilojoule	=	0.948 213 3 British thermal units (Btu as defined in the federal Gas Inspection Act [60° - 61° Fahrenheit])

Reserves Terminology

Original Gas and Original Oil in Place

The volume of oil, or raw natural gas calculated or interpreted to exist in a reservoir before any volume has been produced,

Established Reserves

Those reserves recoverable under current technology and present and anticipated economic conditions, specifically proved by drilling, testing, or production; plus that judgement portion of contiguous recoverable reserves that are interpreted from geological, geophysical, or similar information, with reasonable certainty to exist.

Initial Reserves

Established reserves prior to the deduction of any production.

Remaining Reserves

Initial established reserves less cumulative production.

Definitions of Other Terms

Area

The area used to determine the adjusted bulk rock volume of the oil, or gas-bearing reservoir, usually the area of the zero isopach or the assigned area of a pool or deposit.

Butane

In addition to its normal scientific meaning, a mixture mainly of butanes which ordinarily may contain some propane or pentanes plus.

Compressibility Factor

A correction factor for non-ideal gas determined for gas from a pool at its initial reservoir pressure and temperature and, where necessary, including factors to correct for acid gases.

Condensate

A mixture mainly of pentanes and heavier hydrocarbons that may be contaminated with sulphur compounds, that is recovered or is recoverable at a well from an underground reservoir and that may be gaseous in its virgin reservoir state but is liquid at the conditions under which its volume is measured or estimated.

Density

The mass or amount of matter per unit volume.

Density, Relative (Raw Gas)

The density, relative to air, of raw gas upon discovery, determined by an analysis of a gas sample representative of a pool under atmospheric conditions.

Definitions of Other Terms

Discovery Year

The year in which the well that discovered the oil or gas pool finished drilling.

Formation Volume Factor

The volume occupied by one cubic metre of oil and dissolved gas at reservoir pressure and temperature, divided by the volume occupied by the oil measured at standard conditions.

Gas (Non-associated)

Gas that is not in communication in a reservoir with an accumulation of liquid hydrocarbons at initial reservoir conditions.

Gas Cap (Associated)

Gas in a free state in communication in a reservoir with crude oil, under initial reservoir conditions.

Gas (Solution)

Gas that is dissolved in oil under reservoir conditions and evolves as a result of pressure and temperature changes.

Gas (Raw)

A mixture containing methane, other paraffinic hydrocarbons, nitrogen, carbon dioxide, hydrogen sulphide, helium, and minor impurities, or some of them, which is recovered or is recoverable at a well from an underground reservoir and which is gaseous at the conditions under which its volume is measured or estimated.

Gas (Marketable)

A mixture mainly of methane originating from raw gas, if necessary, through the processing of the raw gas for the removal or partial removal of some constituents, and which meets specifications for use as a domestic, commercial, or industrial fuel or as an industrial raw material.

Gas-Oil Ratio (Initial Solution)

The volume of gas (in thousand cubic metres, measured under standard conditions) contained in one stock-tank cubic metre of oil under initial reservoir conditions.

Gross Heating Value (of dry gas)

The heat liberated by burning moisture-free gas at standard conditions and condensing the water vapour to a liquid state.

Liquid Petroleum Gases (LPG)

A hydrocarbon mixture comprised primarily of propane and butanes. Some ethanes may be present.

Mean Formation Depth

The approximate average depth below kelly bushing of the mid-point of an oil or gas productive zone for the wells in a pool.

Definitions of Other Terms

Methane

In addition to its normal scientific meaning, a mixture mainly of methane which ordinarily may contain some ethane, nitrogen, helium or carbon dioxide.

Natural Gas Liquids

Propane, butanes, or pentanes plus, or a combination of them, obtained from the processing of raw gas or condensate.

Oil

A mixture mainly of pentanes and heavier hydrocarbons that may be contaminated with sulphur compounds, that is recovered or is recoverable at a well from an underground reservoir, and that is liquid at the conditions under which its volume is measured or estimated, and includes all other hydrocarbon mixtures so recovered or recoverable except raw gas or condensate.

Pay Thickness (Average)

The bulk rock volume of a reservoir of oil or gas, divided by its area.

Pentanes Plus

A mixture mainly of pentanes and heavier hydrocarbons which ordinarily may contain some butanes and which is obtained from the processing of raw gas, condensate, or oil.

Pool

A natural underground reservoir containing or appearing to contain an accumulation of liquid hydrocarbons or gas or both separated or appearing to be separated from any other such accumulation.

Porosity

The effective pore space of the rock volume determined from core analysis and well log data, measured as a fraction of rock volume.

Pressure (Initial)

The reservoir pressure at the reference elevation of a pool upon discovery.

Project/Units

A scheme by which a pool or part of a pool is produced by a method approved by the Oil and Gas Commission.

Propane

In addition to its normal scientific meaning, a mixture mainly of propane, which ordinarily may contain some ethane or butanes.

Recovery

Recovery of oil, gas or natural gas liquids by natural depletion processes or by the implementation of an artificially improved depletion process over a part or the whole of a pool, measured as a volume or a fraction of the in-place hydrocarbons so recovered.

Saturation (Water)

The fraction of pore space in the reservoir rock occupied by water upon discovery.

Definitions of Other Terms

Surface Loss

A summation of the fractions of recoverable gas that are removed as acid gas and liquid hydrocarbons, used as lease or plant fuel, or flared.

Temperature

The initial reservoir temperature upon discovery at the reference elevation of a pool.

Unconnected Reserves

Gas reserves which have not been tied-in to gathering facilities and therefore do not contribute to the provincial supply without further investment.

Underbalanced Drilling

A technique in which the hydrostatic pressure in the circulating downhole fluid system is maintained at some pressure less than the pressure of the target formation.

Zone

Any stratum or any sequence of strata that is designated by the Oil and Gas Commission as a zone.



For additional information on the content of this report, contact:

Glynis Farr
Engineering Division
Resource Conservation Department
Oil and Gas Commission
300, 398 Harbour Rd
Victoria, British Columbia V9A 0B7
PHONE: (250) 419-4427 FAX: (250) 419-4402
Glynis.Farr@gov.bc.ca
www.ogc.gov.bc.ca

The Hydrocarbon and By-Product Reserves in British Columbia statistical information will continue to be offered to industry through the Internet at <http://www.ogc.gov.bc.ca/resourceconservationapp.asp>. In an effort to reduce paper waste, hardcopies will not be available.