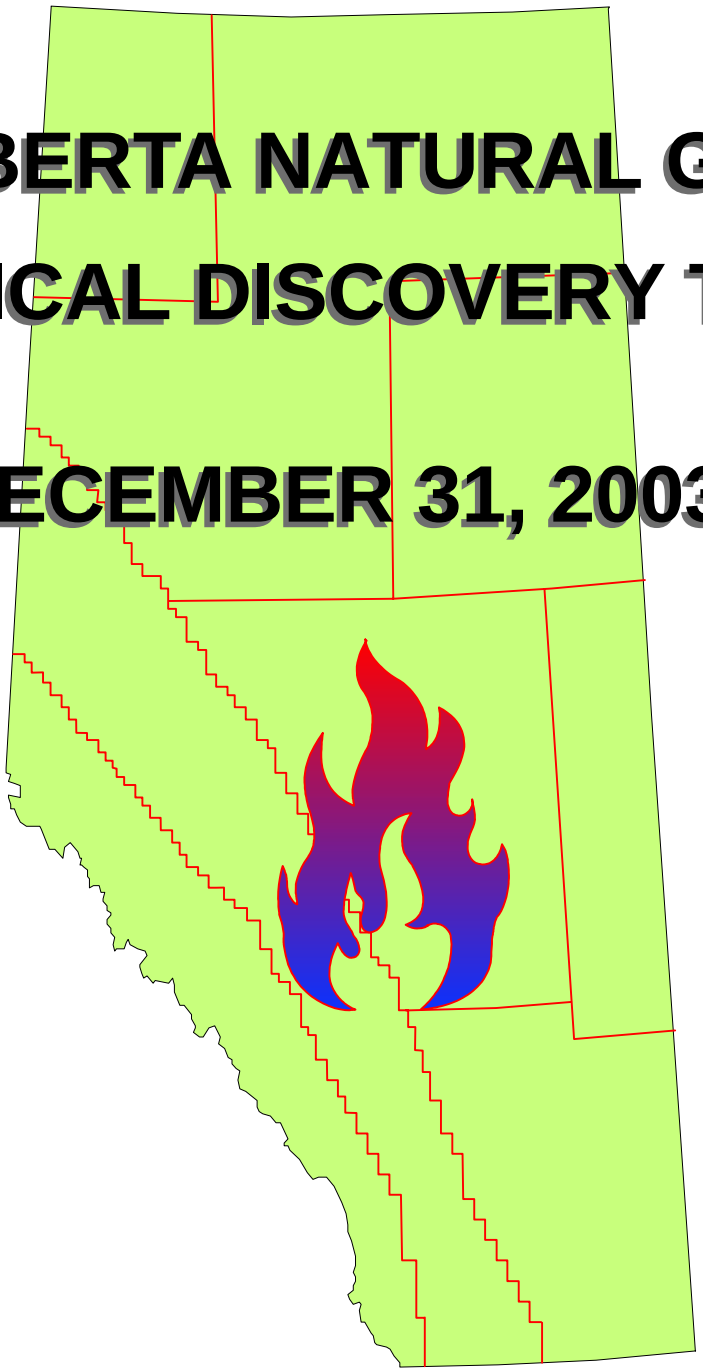
ALBERTA NATURAL GAS
HISTORICAL DISCOVERY TRENDS

DECEMBER 31, 2003



Drummond Consulting

September, 2004

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FOREWORD

This report is a statistical summary of Alberta Natural Gas taken from the 2003 Gas Pool Reserves CD-Rom. The ASCII files were processed, brought into Microsoft Access and additional data fields added so that pools could be aggregated by gas type, geographic area and stratigraphic zone.

The report contains descriptions for all gas pools by area, zone, and discovery sequence. The report uses the ultimate potential numbers of the ERCB 92-A report, "Ultimate Potential and Supply of Natural Gas in Alberta", adjusted to year-end 2003. Alberta's ultimate potential of 204 trillion cubic feet (5,737 billion cubic metres) as reported in ERCB 92-A is considered a reasonable estimate for Alberta. It has been adjusted to reflect changes over the years to give a current estimated ultimate of 218.3 trillion cubic feet.

It is not the intent of this report to present conclusions, but rather to present a synthesis of the data. There is a minimum of evaluation or interpretation of the statistics and distributions. The data is presented in various forms, so that the user can use the information to make their own interpretation and application of the data. The report is mainly tables and charts with a minimum of text.

Statistical summaries are done for all Alberta, for the eight modified PSAC areas as used in the ERCB 92-A Natural Gas Report, and by nine stratigraphic zones. The analysis of the pool data has been done using the Excel data analysis to calculate the descriptive statistics.

Most of the discussion is concentrated on marketable gas. Statistics are given for gas-in-place, raw recoverable gas, and initial marketable gas, however, in general the analysis and charts contained herein focuses primarily on initial marketable gas. The data has also been subdivided by gas type, non-associated gas and combined associated/solution gas pools, and also includes statistics for producing and non-producing pools.

The statistical analysis of year-end 2003 Alberta gas reserves data gives good indicators for what future discoveries could be. The report shows some of the types of summaries that can be made from the excellent data contained in the AEUB reserves database. The study is meant as a reference tool to analyse past discovery trends. The charts and graphs should give a good idea of what historical trends have been, and these can realistically be used to make projections for the future.

ALBERTA'S NATURAL GAS

Initial established natural gas reserves in Alberta, as estimated by the Alberta Energy Utilities Board (AEUB) as of December 31, 2003 is, as follows:

	Billion cubic feet
Initial established gas-in-place	266,351
Initial marketable gas reserves	156,199
Cumulative production, marketable	116,369
Remaining marketable reserves	39,830

The above includes confidential pools, which contain 96.0 billion cubic feet of gas-in-place, with 66.1 billion cubic feet of initial marketable gas reserves. As information on these pools is not available, these volumes will be excluded from the study. The statistics for non-confidential pools, as of December 31, 2003 is as follows:

	Billion cubic feet
Initial established gas-in-place	266,255
Initial marketable gas reserves	156,133
Cumulative marketed production	116,369
Remaining marketable reserves	39,764

The AEUB database includes some pools with a gas-in-place estimate that do not have any marketable gas reserves. These pools have been excluded from this review. There is a difference between the numbers of pools in this report in comparison to the AEUB. However, all of the reserve numbers, gas-in-place, initial marketable gas and cumulative marketable gas produced do agree with the total reported by the AEUB for non-confidential pools.

The author has delineated a total of 33,693 pools in the database. Member pools have been aggregated to the pool level. The 33,693 pools, used in this report, are those with recorded initial gas-in-place. There are an additional 867 pools with no recorded gas-in-place. These pools are not included in any of the statistical analysis in this report.

Non-associated pools account for 28,509 (84.6%) of the pools containing 121,045 billion cubic feet (77.5%) of initial marketable gas. The 5,184 (15.4%) associated and solution gas pools have 35,088 (22.5%) billion cubic feet of initial marketable gas. For Alberta the average non-associated pool size is 4.3 billion cubic feet, compared to 6.8 billion cubic feet for the associated and solution pools.

Distribution of natural gas in Alberta by gas type, not including confidential pools, is as follows:

(Billion cubic feet)

	Non-Assoc.	Solution/Assoc.	Total
Number of pools	28,509	5,184	33,693
Gas-in-place	191,746	74,510	266,255
Initial raw gas	139,824	45,020	184,844
Initial marketable gas	121,045	35,088	156,133
Cum. marketed production	89,416	26,953	116,369
Rem. marketable reserves	31,629	8,135	39,764

The AEUB estimate of 39.8 trillion cubic feet for remaining established reserves of marketable gas at December 31, 2003 is a decrease of 1.7 trillion cubic feet since December 31, 2002. The flow diagram of figure 1 shows production, additions and reductions to reserves that occurred during 2003. New pool discoveries contributed 2.1 trillion cubic feet. Development drilling added 1.6 trillion cubic feet and re-evaluations were a negative 0.6 trillion cubic feet.

GRAPHICAL SUMMARY ALBERTA REMAINING MARKETABLE RESERVES

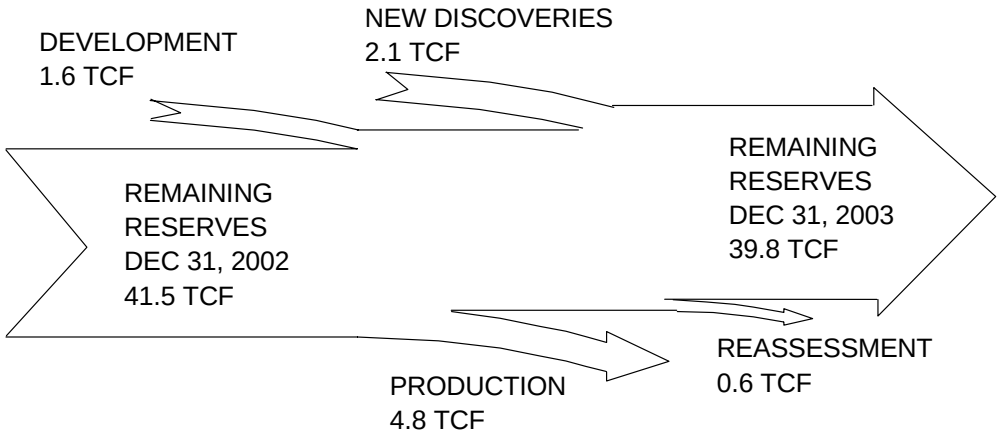


Figure 1 **Graphical summary of Alberta's remaining marketable gas reserves as of December 31, 2003, showing changes that occurred during 2003.**

Alberta Natural Gas Ultimate Potential

In June 1992, the Alberta Energy Utilities Board (Energy Resources Conservation Board at the time) published the detailed report on Alberta's ultimate gas potential, ERCB Report 92-A, "Ultimate Potential Supply of Natural Gas in Alberta". In this report they adopted an estimate of 5600 billion cubic metres (200 Tcf) as Alberta's ultimate potential for marketable natural gas. This number comes from the medium case, which is actually 5736.55 billion cubic metres (203.6 Tcf), as shown in Table 4.3 of the report. The National Energy Board in their status of Canada’s conventional gas resources included an assessment for Alberta, with an ultimate marketable gas resource of 207 trillion cubic feet. This report has used the 92-A report ultimate potential, and made adjustments for changes over the years, and included considerations from the National Energy Board report. This results in a current estimated ultimate potential of 218.3 trillion cubic feet.

The AEUB in the year-end 2003 report, ST 2004-98, estimates the initial established marketable gas reserves at 156.1 trillion cubic feet.

The distribution of the ultimate marketable gas potential for Alberta is shown in figure 2. Fifty three percent of the initial resource has been produced, with remaining reserves accounting for 18% (39.8 trillion cubic feet) and 28% (62.0 trillion cubic feet) still to be discovered.

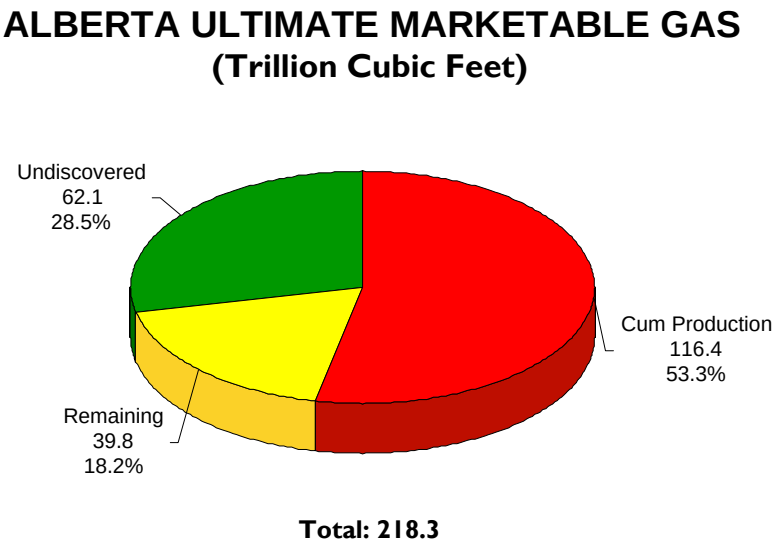


Figure 2 Alberta Ultimate marketable gas potential as of December 31, 2003

Gas Reserves Statistics

Reserves statistics for Alberta non-confidential gas pools as of December 31, 2003 are presented in Table 1.1. The full descriptive statistics as derived using Excel data analysis are given for initial established gas-in-place, raw recoverable, and marketable gas, subdivided by gas type. Total discovered gas-in-place is 266,255 billion cubic feet. Initial raw recoverable reserves are 184,844 billion cubic feet, for a recovery factor of 69.4 %. Initial established marketable gas reserves are 156,133 billion cubic feet. Marketable gas recovery factors are 84.5 % of raw recoverable gas and 58.6 % of gas-in-place.

A summary of some of the more important statistics for initial marketable gas is:

Number of Pools	33,693	
Initial established	156,133	billion cubic feet
Largest Pool	5,341	billion cubic feet
Average pool size	4.63	billion cubic feet
Median pool size	.50	billion cubic feet
95th percentile	10.123	billion cubic feet

Pool Size Distribution

The distribution of Alberta's initial marketable gas reserves by pool size is shown in figures 1.1, and 1.2. The class sizes used are only approximately lognormal, as the author prefers units of 1, 2, 5, 10, 20, etc., rather than statistically correct class intervals of 1, 2, 4, 8, 16, etc.

Figure 1.1 shows the data table, a summary of the statistics, and charts of the distributions for number of pools and volume of initial marketable gas, with bar charts showing the frequency distribution of pool sizes, and line graphs showing the cumulative frequency distribution. The charts

of figure 1.2 combine the number of pools (line) and volumes (bars) into one chart. The top left chart A shows the proportion of cumulative production to remaining reserves and the top right chart B shows the number and volume distributions by gas type, non-associated and associated/solution. The bottom charts C and D are percentage plots of initial marketable gas volumes of the top charts.

Except for the two largest class, which are all non-associated, solution gas is somewhat more important in the larger pool classes. The percentage plot of cumulative production and remaining reserves shows the smaller pool sizes have a higher percentage of remaining marketable gas than do the larger pools. For pools greater than 50 billion cubic feet, remaining marketable reserves is 21.1% (19,818 billion cubic feet), compared to 32.0% (19,946 billion cubic feet) for pools less than 50 billion cubic feet. For the 49 pools greater than 500 billion cubic feet, 21.7% (11,474 Bcf) of the initial marketable gas is remaining reserves.

Non - Producing Pools

Producing pools are those, which have had production. Non-producing pools are those, which have zero production as of December 31, 2003.

The 7,017 pools in Alberta with no production contain 2.4 trillion cubic feet of initial marketable gas, for an average pool size of 0.35 billion cubic feet of initial marketable gas, and a median of 0.18 billion cubic feet. The largest pool with no production is Medicine Hat Colorado H, discovered in 2002, with initial marketable gas reserves of 39.3 billion cubic feet.

Table 1.3 gives the pool count and gas volumes for the non-producing pools by year of discovery. The year 1978 marks a significant change in the non-producing pools. A total of 663 non-producing pools with 332 billion cubic feet, marketable, were discovered before 1978. From 1978 through 2002 there were a total of 6,227 pools with 2,037 billion cubic feet of initial marketable gas that have no production to the end of 2002. The average during this period has been 249 non-producing pools discovered each year.

Table 1.4 includes four tables, which summarizes the non-producing pools by geographic area, stratigraphic zone, gas type and decade of discovery. Areas 2, 3, and 5 have 61.6% of the non-producing pools with 70.5% of the non-producing marketable gas. By far the majority of the non-producing pools are of Lower Cretaceous age, with zones C and D, having 66.3% of the pools and 55.8% of the marketable reserves. Seventy-three percent of the non-producing pools, containing 82.5% of the marketable gas reserves are non-associated. The 1990's produced the majority of the non-producing pools with 2,953 (42.1%) pools containing 1.1 trillion cubic feet (37.3%) of marketable gas.

Table 1.5 shows the descriptive statistics for the non-producing pools. Non-producing pools have a mean for marketable gas of 0.35 billion cubic feet, a median of 0.18 Billion cubic feet and a 95th percentile of 1.1 billion cubic feet. Comparative values for producing pools and all pools are shown in the table.

Alberta's distribution of initial marketable gas for pools with production and those with no production by gas type is shown in table 1.6 and figure 1.3. As shown all non-producing pools have less than 50 billion cubic feet of initial marketable gas. Ninety-nine percent of the non-producing pools are less than 5 billion cubic feet in size, and contain 2,251 billion cubic feet (92.9 %) of the non-producing marketable gas. For all pools less than 5 billion cubic feet, 22.9 % are non-producing and they contain 8.9 % of the initial marketable gas in pools of this size.

Table 1.7 shows the first page of the pools, ranked by initial marketable gas, in Alberta, which have no production as of December 31, 2003.

ALBERTA

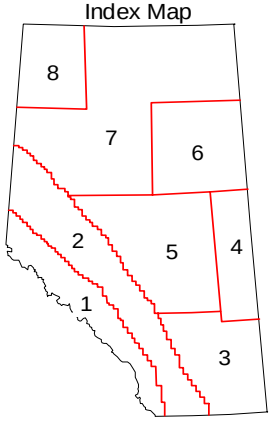
POOL SIZE DISTRIBUTION

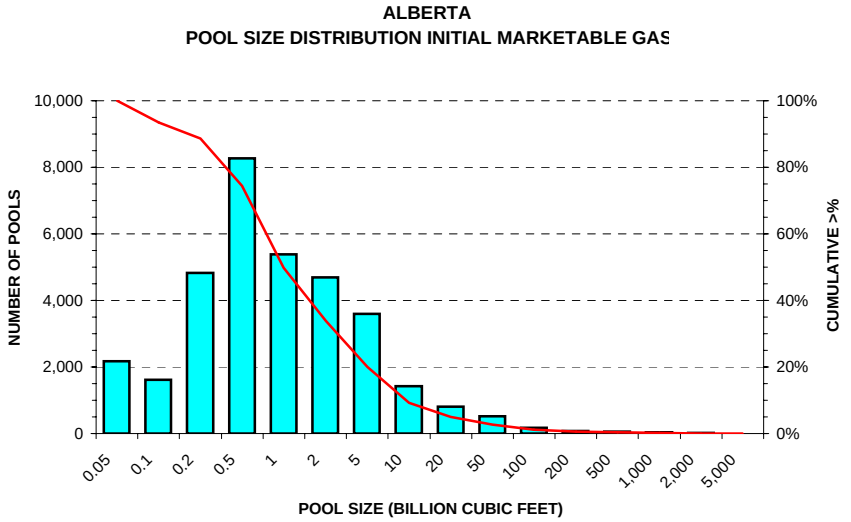
INITIAL MARKETABLE GAS (Billion Cubic Feet)

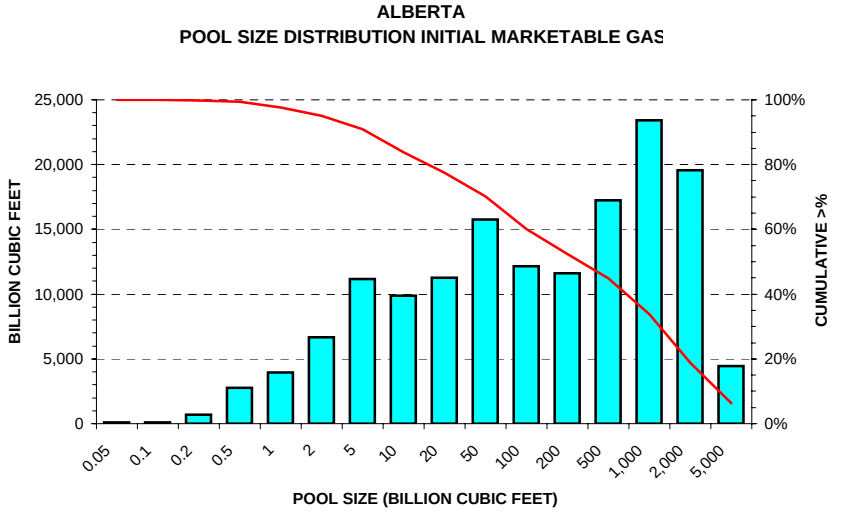
Size Bcf	No. of Pools	IMG Bcf	% of Pools	Cum % Pools	% of IMG	Cum % IMG
0.05	2,178	77	6.46%	100.00%	0.05%	100.0%
0.1	1,619	115	4.81%	93.54%	0.07%	100.0%
0.2	4,826	684	14.32%	88.73%	0.44%	99.9%
0.5	8,264	2,763	24.53%	74.41%	1.77%	99.4%
1	5,390	3,943	16.00%	49.88%	2.53%	97.7%
2	4,699	6,666	13.95%	33.88%	4.27%	95.1%
5	3,604	11,149	10.70%	19.94%	7.14%	90.9%
10	1,414	9,891	4.20%	9.24%	6.33%	83.7%
20	810	11,277	2.40%	5.04%	7.22%	77.4%
50	528	15,779	1.57%	2.64%	10.11%	70.2%
100	173	12,144	0.51%	1.07%	7.78%	60.1%
200	81	11,634	0.24%	0.56%	7.45%	52.3%
500	58	17,226	0.17%	0.32%	11.03%	44.8%
1,000	31	23,437	0.09%	0.15%	15.01%	33.8%
2,000	15	19,582	0.04%	0.05%	12.54%	18.8%
5,000	2	4,423	0.01%	0.01%	2.83%	6.3%
10,000	1	5,341	0.00%	0.00%	3.42%	3.4%
Total	33,693	156,133				

Total Number of Pools	33,693
Initial Marketable Gas	156,133
Largest Pool	5,341
Mean Pool Size	4.63
Median Pool Size	0.50
95th Percentile	10.12
75th Percentile	1.53
25th Percentile	0.18
5th Percentile	0.04

Index Map







HISTORICAL DISCOVERY TRENDS

This section discusses the historical discovery trends of natural gas for Alberta as a whole. Further discussion of historical trends by geographic area and stratigraphic zone is included in the sections to follow.

The historical record has been analysed by year of discovery, decade of discovery, by equal sets of pools representing 10% of the total population, and the top 10 pools discovered each year. Descriptive statistics are done and these can be used to accurately define the distribution of discovered pools by year, decade, and sets of pools, to give a reasonable estimate for future discoveries and planning of exploration programs. Similar analysis is done by area and zone.

It is clear that the future gas resources for Alberta must come from a large number of small pools. Larger pools are still very important and the growth percentile statistics of table 2.3 indicate that 5% of the pools to be discovered could be larger than 10.1 billion cubic feet.

As shown in the various discovery trend analyses the discovery history for the 1980's and 1990's is remarkably consistent. The averages have been essentially flat for the most recent years. Recent Alberta gas discovery trends, suggest that the industry can expect similar performance for the next decade. Certain definite patterns and trends are clearly evident in the synthesis.

Year of discovery

Statistics for Alberta initial marketable gas by year of discovery are presented in table 2.1, and shown graphically in figure 2.1. Shown in the chart are the average (mean) and median pool sizes. The inset shows the period 1970 to 2003 in a little more detail. The data clearly shows the larger pools were discovered early in the history of the Alberta gas industry. Both the median and average pool size have been relatively constant throughout the 1990's, with an average mean of 1.3 billion cubic feet and average median of 0.5 billion cubic feet.

For most of the areas the recent history (1980's and 1990's) indicates a fairly constant discovery record. This period can be used as a good indicator for discoveries in the next few years.

Top 10 pools per year

Table 2.2 shows marketable gas reserves in the 10 largest gas pools discovered each year. The marketable gas discovered per year by the top 10 pools is shown in figure 2.2. Ten year moving averages are plotted for volume of marketable gas and the percentage of gas represented by the top 10 pools. The data for the two years, 2001 to 2002 (2003 information is still incomplete) indicates an average for the top 10 pools of about 301 billion cubic feet, representing 17.7% of the total gas discovered in the two years. This would suggest about 2 trillion cubic feet to be discovered per year for possibly the next few years.

ALBERTA - INITIAL MARKETABLE GAS
AVERAGE AND MEDIAN POOL SIZE BY YEAR OF DISCOVERY

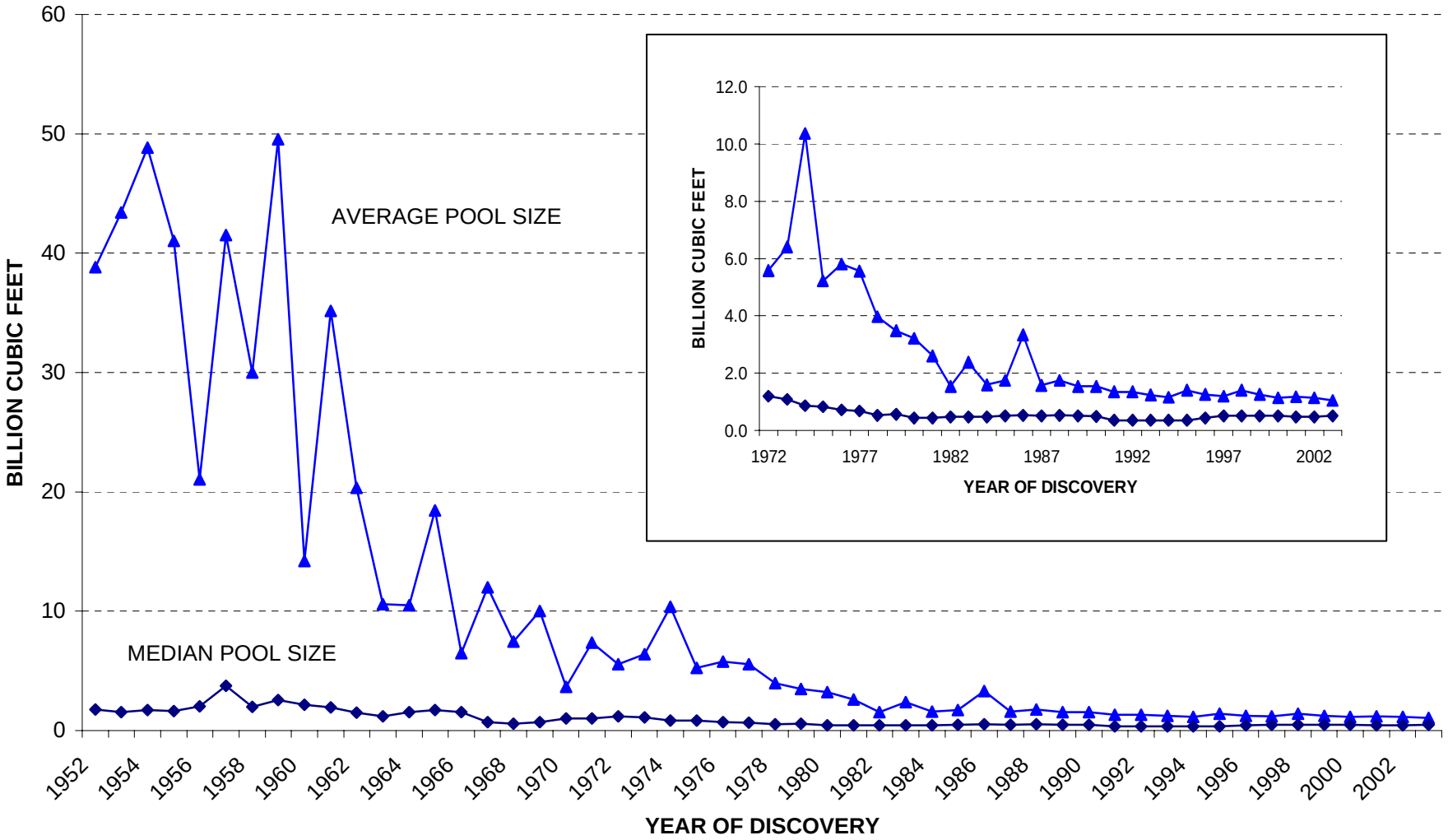


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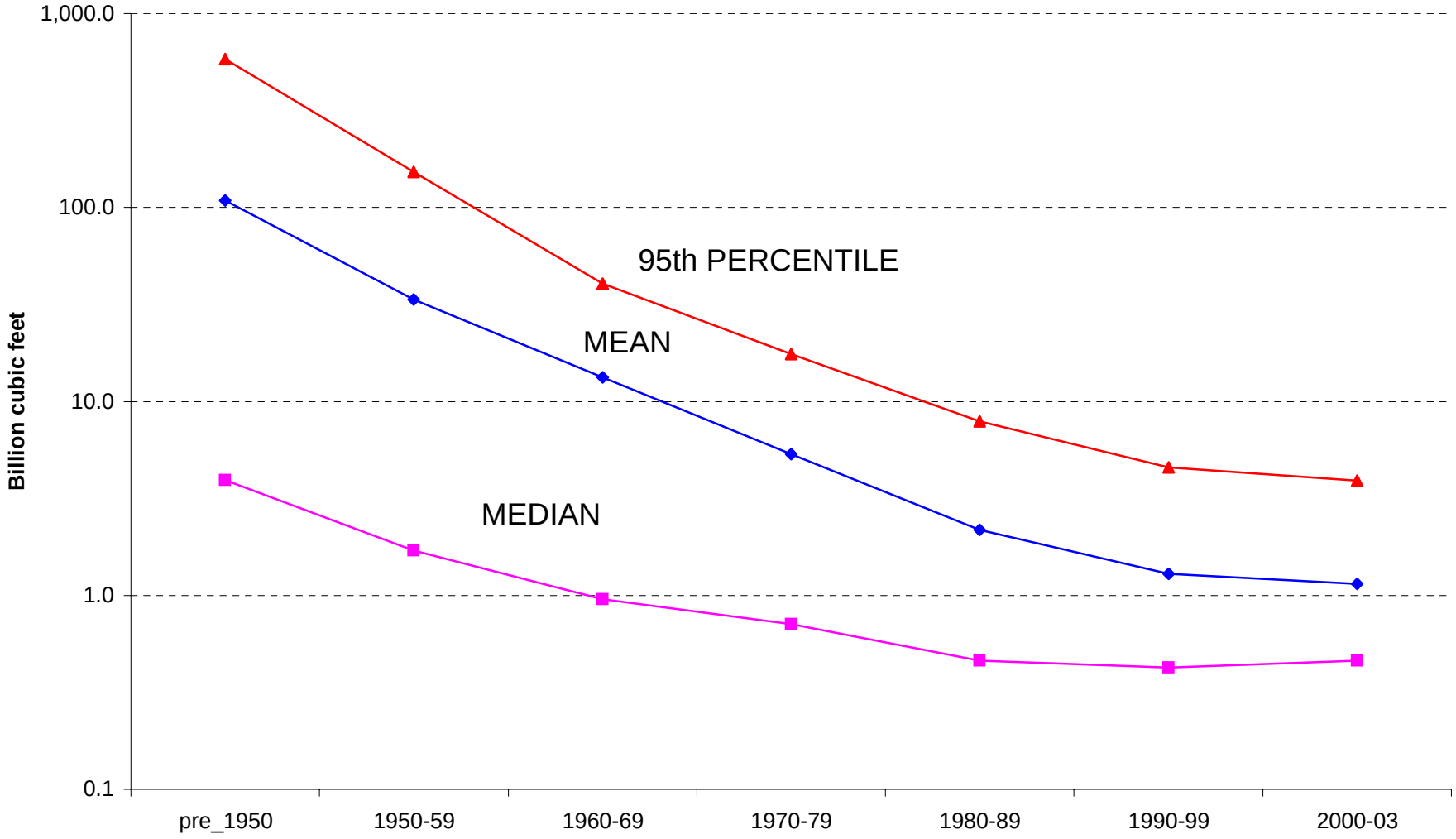
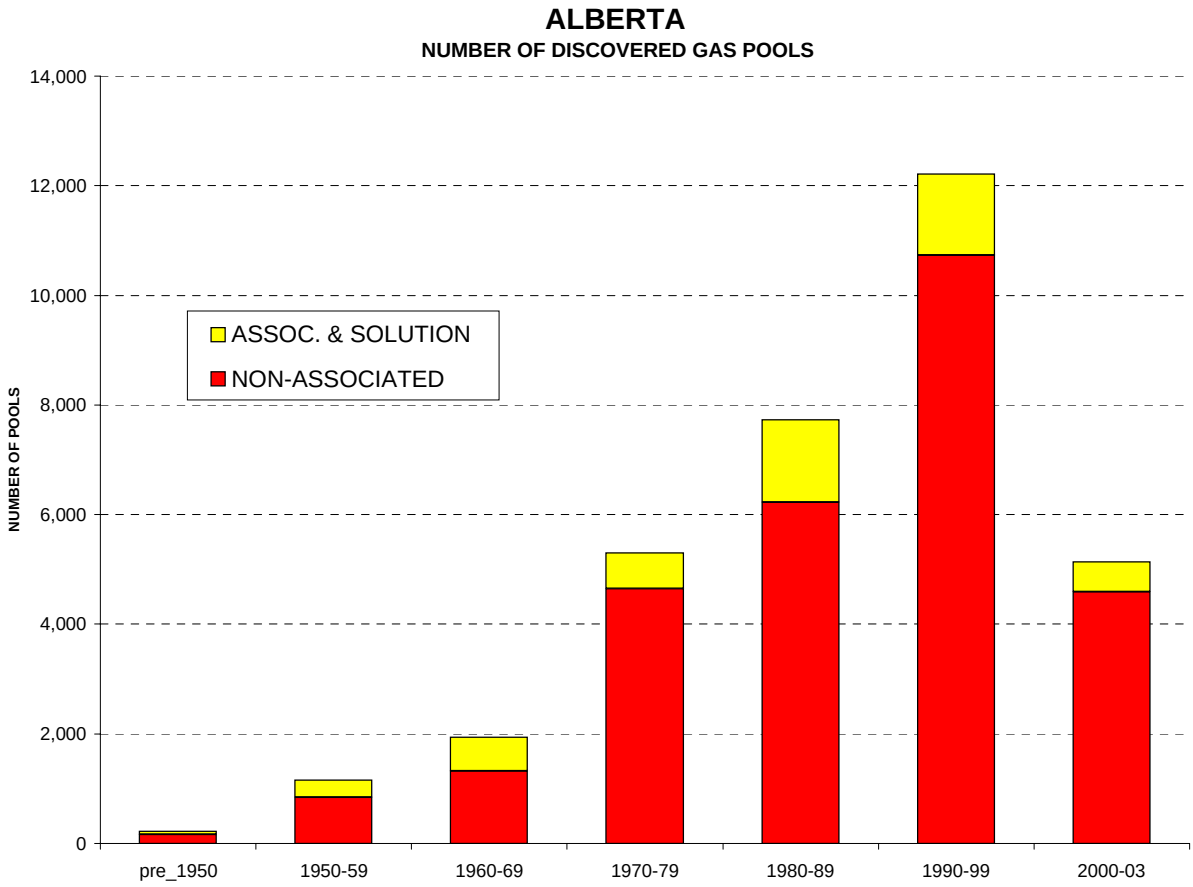
Figure 2.1

ALBERTA - INITIAL MARKETABLE GAS
POOL SIZE BY DECADE DISCOVERED



Gas Stats2003 by Decade.xls

Figure 2.5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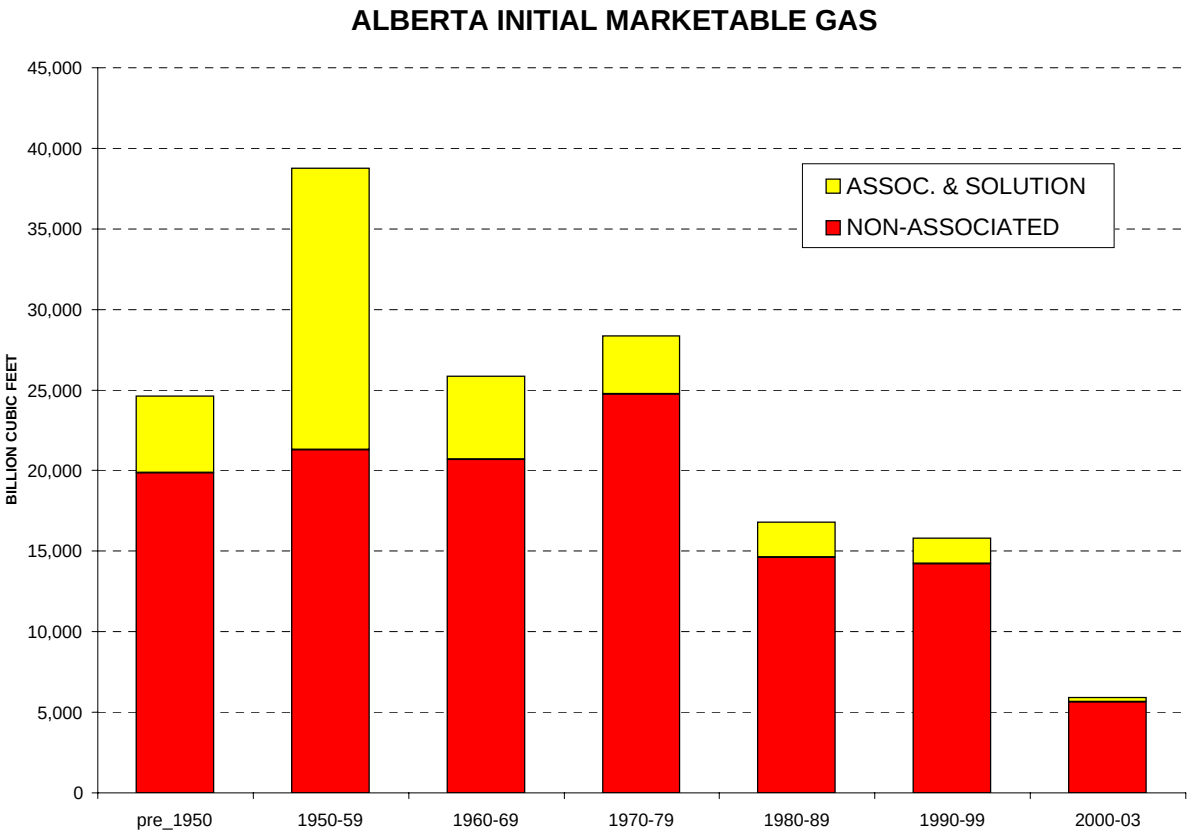
NUMBER OF DISCOVERED GAS POOLS
NUMBER OF POOLS
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
ASSOC. & SOLUTION
NON-ASSOCIATED
pre_1950
1950-59
1960-69
1970-79
1980-89
1990-99
2000-03


ALBERTA INITIAL MARKETABLE GAS
BILLION CUBIC FEET
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
ASSOC. & SOLUTION
NON-ASSOCIATED
pre_1950
1950-59
1960-69
1970-79
1980-89
1990-99
2000-03

AREA SUMMARY

The geographic areas used in this study are the eight "modified-PSAC areas", as established by the AEUB in the 92-A report. The areas correspond to the Petroleum Services Association of Canada's areas, except that area 7 has been subdivided to include an area 8 in Northwest Alberta.

The distribution of Alberta's ultimate marketable gas by geographic area is shown in figure 3.1. The areas with the largest volume of ultimate marketable gas are areas 2, 3 and 5, which in total have 70.8% of Alberta's ultimate potential. The largest is area 2, with an estimated 73.7 trillion cubic feet of ultimate marketable gas, followed by area 5 with 41.1 trillion cubic feet and area 3 with 39.6 trillion cubic feet. Areas 1, 2, and 5 have the largest undiscovered potential, 65.1 % of the total. Area 2 is ranked first with undiscovered initial marketable gas potential of 22.6 trillion cubic feet, followed by area 5 at 9.4 trillion cubic feet and area 1 with 8.4 trillion cubic feet.

The areas with the largest percentage of marketable gas still to be discovered include areas 7(48.0 %), 8 (40.3%) and 1 (35.3%). Areas with the smallest percentage of undiscovered gas are areas 3 (18.0%) and 5 (22.9%). For Alberta 28.4% of the ultimate gas potential remains to be discovered.

For each of the geographic areas, the information in the report includes 1) the cumulative discovery plot with moving average curves, 2) tables and charts of pool size distribution, 3) distribution of marketable gas and statistics by stratigraphic zone, 4) Statistics for sets of pools arranged in chronological order, with a plot showing the 95th percentile, mean and median, and 6) the first page of the list of pools ranked by initial marketable gas.

Figure 3.2 shows the geographic distribution of marketable gas for the various areas by gas type, and table 3.2 includes the statistics for the areas by gas type. Associated and solution gas is located in the central and northwest areas of the province. Area 8 has the highest percentage of pools, followed by area 7 and area 2. The highest percentages by volume are areas 5, 8 and 4. The high percentage by volume for area 4 is related to one large multi-zone pool, Provost Vik, BR, BCol & Mann MU#1. A more detailed map view of the distribution for each stratigraphic horizon by area is shown in the figures included under the specific zones.

The geographic distribution of marketable gas by type is shown in the pie charts of Figure 3.3. The area with the largest number of non-associated gas pools is area 5, followed by areas 3, 2, and 4. These 4 areas have 84% of the pools and 76% of the initial non-associated marketable gas. The number of associated/solution pools is more uniform. Area 3 has the largest number, with 1,312, followed by area 2, 5 and 8. These 4 areas have 82% of the pools and 85% of the initial marketable gas. Areas 2 and 5 have the majority of the associated/solution gas with 72% of the total. There is no reported associated/solution gas in area 6.

ALBERTA ULTIMATE GAS POTENTIAL (DECEMBER 31, 2003)

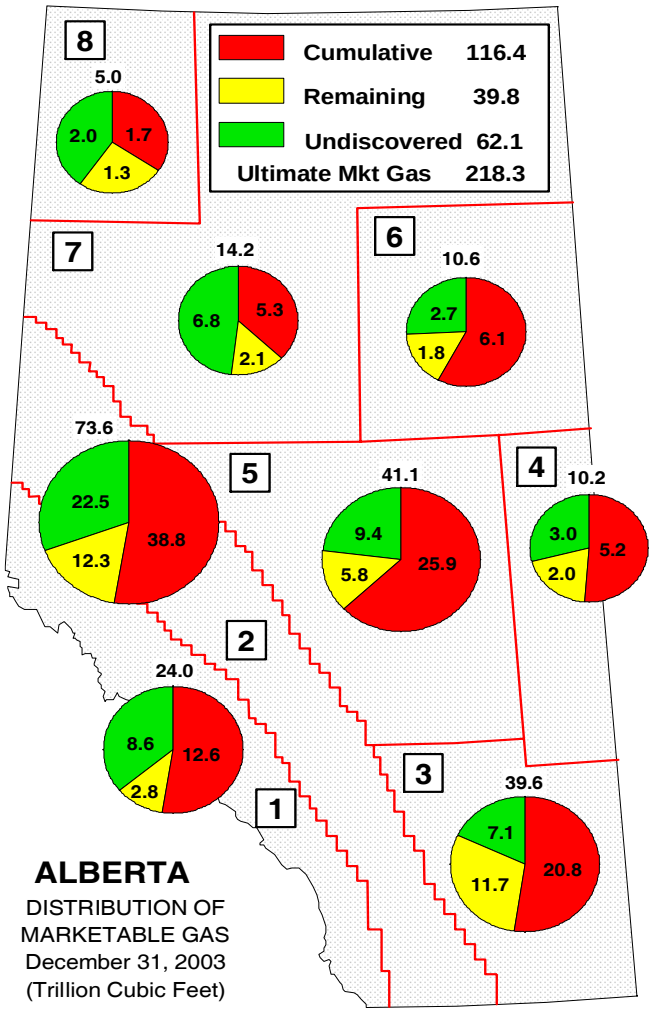
ALBERTA DISCOVERED GAS (Billion cubic feet)

AREA	Count	GIP	IRRG	IMG	CumMG	RemMG
1	513	26,793	21,525	15,353	12,585	2,768
2	6,105	98,139	64,505	51,141	38,801.7	12,339
3	7,448	51,142	34,862	32,485	20,756	11,730
4	4,065	11,368	7,767	7,234	5,250	1,984
5	10,330	51,491	36,179	31,725	25,908	5,817
6	1,809	10,893	8,287	7,868	6,104	1,763
7	1,856	10,993	8,103	7,355	5,256	2,099
8	1,567	5,437	3,616	2,971	1,708	1,263
Total	33,693	266,255	184,844	156,133	116,369	39,764

ALBERTA ULTIMATE GAS POTENTIAL (Billion cubic feet)

AREA	ULTGIP	IGIP_RSV	UND_GIP	ULTMG	IMG	UND_MG
1	41,821	26,793	15,028	23,984	15,353	8,631
2	136,489	98,139	38,350	73,621	51,141	22,480
3	62,441	51,142	11,298	39,611	32,485	7,126
4	15,898	11,368	4,530	10,201	7,234	2,966
5	66,703	51,491	15,212	41,137	31,725	9,412
6	14,879	10,893	3,986	10,586	7,868	2,718
7	21,002	10,993	10,009	14,162	7,355	6,807
8	8,754	5,437	3,318	4,975	2,971	2,004
Total	367,987	266,255	101,731	218,279	156,133	62,146

Ultimate potential estimates adapted from ERCB REPORT 92-A, Ultimate Potential and Supply of Natural Gas in Alberta



Explanation

Count	Number of pools	ULTGIP	Ultimate gas-in-place
GIP	Initial gas-in-place	IGIP_RSV	Initial gas-in-place (AEUB ST 2004-98)
IRRG	Initial raw recoverable gas	UND_GIP	Undiscovered gas-in-place
IMG	Initial marketable gas	ULTMG	Ultimate marketable gas
CumMG	Cumulative marketed gas	IMG	Initial marketable gas (AEUB ST 2004-98)
RemMG	Remaining marketable gas	UND_MG	Undiscovered marketable gas

STRATIGRAPHIC ZONES

The stratigraphic zones used in this report are modified slightly from the zones used in the National Energy Board Producer's response report, 1997. Zone G has been subdivided into G1 - Upper Devonian and G2 - Middle Devonian and older. Zone E, Jurassic to Pennsylvanian, in some of the charts and tables has been subdivided into E1 - Jurassic, E2 - Triassic, and E3 - Perm-Pennsylvanian, but generally these are grouped as Zone E. Zone D has been subdivided into D1 - Lower Cretaceous above Glauconite and D2 - Lower Cretaceous Glauconite and below, as zone D in total has 60.5% of the pools with 31.9% of the marketable gas.

The pie charts of figure 4.1 show the stratigraphic distribution of non-associated and associated /solution gas pools. For non-associated pools the Lower Cretaceous Glauconite and below (zone D2) is the most dominant with 27.6% (7,867) of the non-associated pools and 20.6% of the initial marketable gas. The number and volumes for associated/solution pools are more evenly distributed. The older Devonian formations (zones G1 and G2) are more important for associated/solution gas, as 36.7% of the initial marketable gas in these horizons is associated/solution gas, compared to 25.3% for the Mississippian and 17.6% for the Mesozoic.

The stratigraphic distribution of all gas pools is shown in figure 4.3. The Lower Cretaceous Glauconite and below has 11,134 pools, 33.0% of the total. By initial marketable gas the Mississippian has 18.4% of the gas, followed by the Lower Cretaceous Glauconite and below with 18.3 %, and Above Glauconite with 13.7%. The largest average pool size is the Milk River, Medicine Hat, Second White Specks. The smallest average pool size is the Lower Cretaceous Above Glauconite.

The bar charts of figure 4.2 show the volume of gas-in-place, raw recoverable gas and initial marketable gas by gas type. The charts on the right-hand side show the recovery factors for the various stratigraphic horizons (also see table 4.1). Marketable gas recovery factors for all pools range from 36.8% for zone B (Upper Cretaceous other) to 69% for the Lower Cretaceous Viking/Bow Island. The overall recovery is 69.4% for recoverable raw gas and 58.6% of total gas-in-place is marketable. For non-associated pools the overall average recovery is 73% for recoverable raw gas and 63% marketable. For associated/solution pools recoveries are lower, ranging from a marketable gas recovery of only 23% for zone B, Upper Cretaceous other, to 64% for zone D1, the Lower Cretaceous Above Glauconite. The low recoveries for associated/solution pools in zone B are due to the Cardium sand pools, in particular dominated by the giant Pembina Cardium sand oil pool.

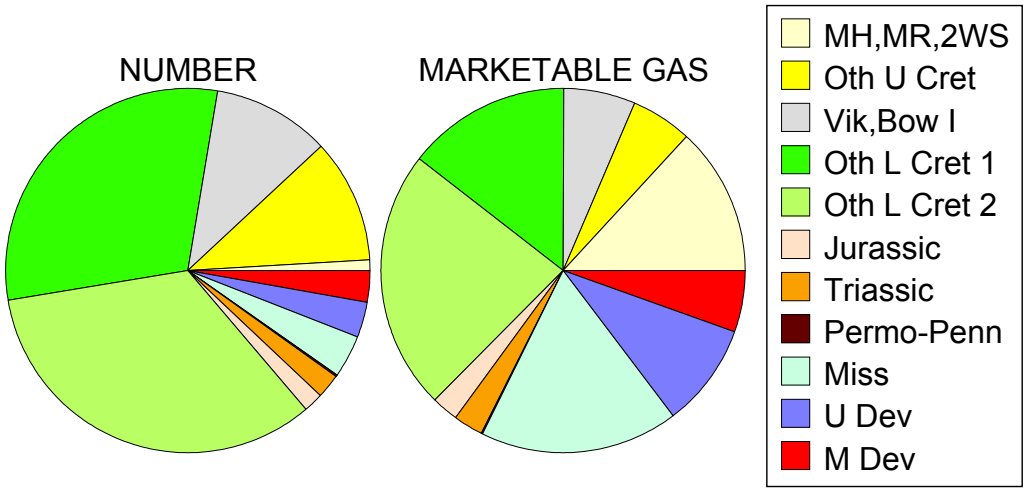
Table 4.2 gives the detailed statistics for initial marketable by gas type. For all pools the mean ranges from a low of 1.9 billion cubic feet for the Lower Cretaceous Above Glauconite (zone D1) to a high of 49.5 billion cubic feet for the multi-field pools of zone A (Medicine Hat, Milk River, 2WS). The corresponding median values are 0.43 billion cubic feet for zone D1 and 0.50 billion cubic feet for zone A. The 95th percentile values range from a low of 6.2 billion cubic feet for zone D1 to a high of 83.5 billion cubic feet for zone A.

Table 4.4 is a listing of the first 10 discoveries by finish drill date for each of the stratigraphic zones.

ALBERTA NATURAL GAS
STRATIGRAPHIC DISTRIBUTION

NON-ASSOCIATED GAS POOLS

as of December 31, 2002



ALBERTA NATURAL GAS
STRATIGRAPHIC DISTRIBUTION

ASSOCIATED & SOLUTION GAS POOLS

as of December 31, 2002