EAST COAST GAS - THE BIG PICTURE

Presented by

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The title of my paper is East Coast Gas - The Big Picture, in which I will review the North America gas resource base, and show how the East Coast fits into this overall picture.

The total conventional ultimate natural gas resource base for North America at year end 1996 is estimated to be 2,695 trillion cubic feet, distributed as shown in figure 1 and table 1.

Figure 1 shows the distribution by country; United States - 1,825 Tcf (161 Tcf in Alaska and 1,664 Tcf for the lower 48 States), Canada - 595 Tcf (273 Tcf in the producing areas and 323 Tcf in the Frontier areas), and Mexico 275 Tcf. The details are shown in table 1. Of this total resource cumulative production accounts for 1,047 Trillion cubic feet, remaining reserves and resources 349 Tcf and 1,299 Tcf still to be discovered.

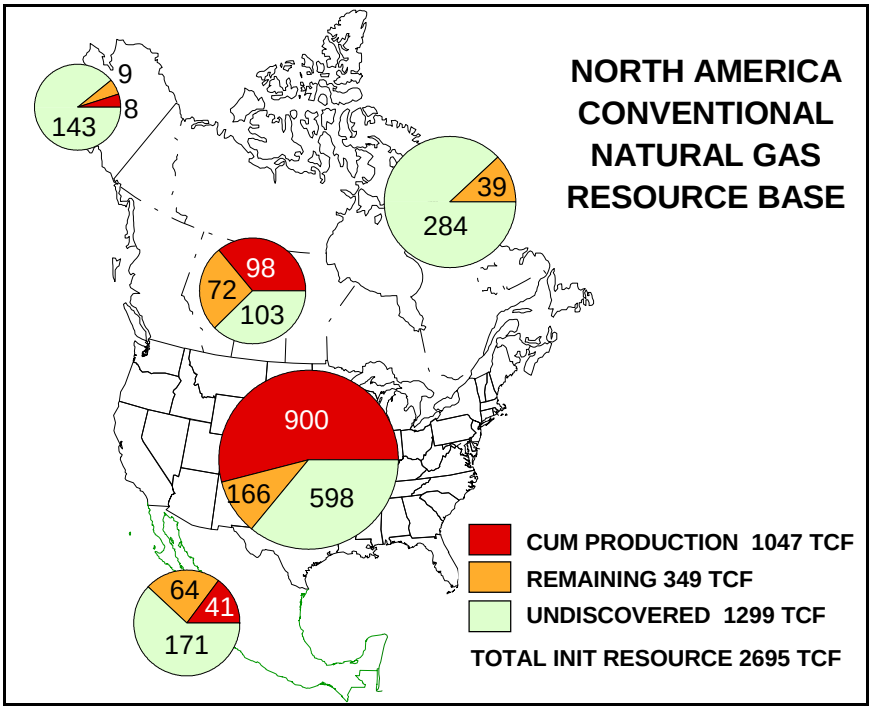

Figure 1 North America conventional natural gas resource base as of December 31, 1996.

The more important supply areas are Canada and the USA. Mexico and Alaska are expected to play only a minor role in the overall United States and Canada supply, so for this report North America will refer to only Canada and the lower 48 States.

Table 1.

NORTH AMERICA CONVENTIONAL NATURAL GAS RESOURCE BASE

DECEMBER 31, 1996

(TRILLION CUBIC FEET)

	CUM PROD.	REMAINING RESERVES/ RESOURCES	TOTAL DISCOVERED RESOURCES	UNDISCOV. RESOURCES	ULTIMATE RESOURCES	REM. RESOURCE
UNITED STATES						
ALASKA	8.1	9.3	17.4	143.1	160.5	152.4
LOWER 48 STATES	900.1	165.8	1,065.9	598.4	1,664.3	764.2
TOTAL USA	**908.2**	**175.1**	**1,083.3**	**741.5**	**1,824.8**	**916.6**
CANADA						
PRODUCING AREAS	98.1	71.7	169.8	102.7	272.5	174.4
FRONTIER	0.0	38.5	38.5	284.2	322.7	322.7
TOTAL CANADA	**98.1**	**110.2**	**208.3**	**386.9**	**595.2**	**497.1**
MEXICO	**40.8**	**63.9**	**104.7**	**170.7**	**275.4**	**234.6**
NORTH AMERICA	**1,047.1**	**349.2**	**1,396.3**	**1,299.1**	**2,695.4**	**1,648.3**

This presentation will focus on conventional gas resources. A certain portion of unconventional gas is already being produced by conventional methods, as coalbed methane and some tight gas. The GRI 1997 baseline report shows about 20% of US production is unconventional, and their projections indicate a similar percentage for 2020. Certainly unconventional gas accumulations will make a significant contribution in the future.

About half of the conventional gas estimated to exist in North America remains to be discovered. Of the half that has been discovered, 78% has been produced and only 22% of it is remaining reserves. A large portion, approximately 38%, of the undiscovered natural gas resource is in the Frontier regions of Alaska and Canada. This frontier gas resource is going to become increasingly important to the US and Canada market.

The major supply areas of North America (table 2), Gulf Coast, Rocky Mountains, Western Canada, and the Mid-Continent account for 90% of the cumulative production to date, 87% of the remaining reserves/resources and 51% of the undiscovered potential. These regions, in particular the Gulf Coast, are expected to continue to play a dominant role.

With the depleting gas resource in the conventional producing areas of North America, where will future natural gas resources come from? One area could be the East Coast of North America. The US east coast offshore and Georges Bank of Canada is presently under moratorium and off limits. One available area is the Nova Scotia offshore, which is scheduled to join the producing areas by the turn of the century.

Figure 2 shows the distribution of ultimate conventional marketable gas resources for Canada. Cumulative production is 98.1 Tcf, remaining reserves 64.0 Tcf, discovered resources 46.2 Tcf, and undiscovered resources 386.9 Tcf, for a total endowment of 595.2 Tcf. Almost two-thirds of Canada's total gas resource base remains to be discovered, and a significant proportion of this is in remote Frontier regions. Excluding areas under moratorium, and the remote Arctic regions the estimated undiscovered potential is approximately 177 Tcf. Including discovered reserves and resources of 110.2 Tcf, a remaining 287 Tcf is potentially available as a resource for the near future.

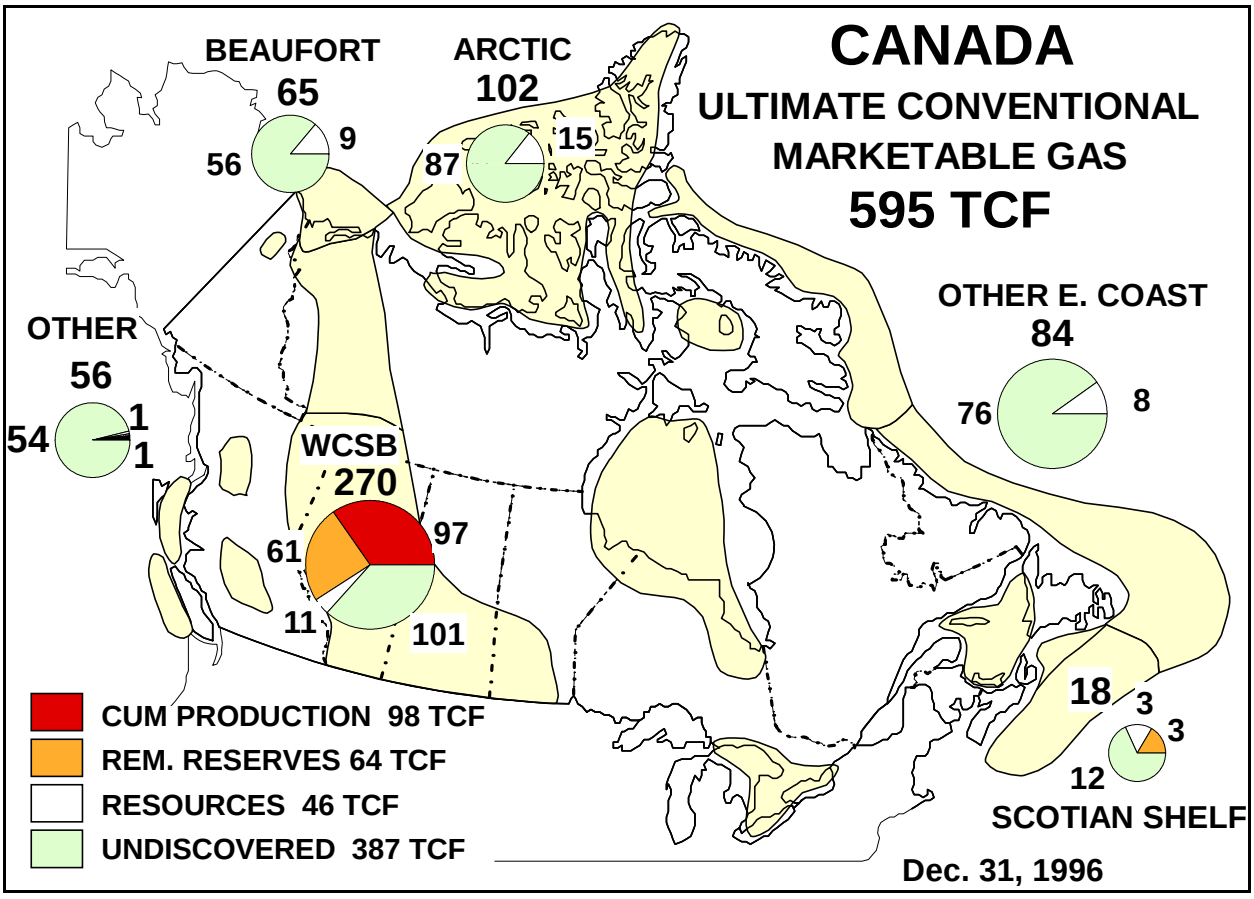

Figure 2 Estimated ultimate conventional marketable gas resources of Canada.

There are very few recent estimates for the undiscovered potential in many of Canada's Frontier areas. The last complete report on Canada's undiscovered potential was GSC Paper 83-31, published in 1984. The ultimate gas resource estimated at that time was 444.5 Tcf. Many areas have more recent assessments, however we still need to rely on this report for some regions. In this review I have used all available estimates from provincial and federal agencies, and compiled these to get an overall current best estimate for Canada's ultimate gas resources. A more detailed summary of the resource base for Canada and the USA is included in table 2.

In May 1997 the Canadian Gas Potential Committee published the Natural Gas Potential in Canada. This report assessed the potential of the Western Canada Sedimentary Basin and selected Frontier areas. The results of this study show an undiscovered conventional marketable gas estimate of 122 Tcf for the Western Canada Sedimentary Basin, and 107 Tcf for the Frontier areas.

I will outline in a little more detail the natural gas resource of Eastern North America. The major producing area in this region is the Gulf Coast, which has 65.0 Tcf of remaining reserves (39% of the Lower 48 States) and an estimated undiscovered potential of 236.5 Tcf (40% of the total remaining). For the Atlantic region the main producing area is the Appalachian basin, which has been producing gas since the 1890's. Cumulative production from the Appalachian region is 36.1 Tcf, with remaining reserves of 7.6 Tcf. The undiscovered gas resource is estimated to be 46.0 Tcf by the Potential Gas Committee in their 1996 report and only 2.8 Tcf by the USGS in the 1995 National Assessment. However, the USGS attributes a potential of 62.1 Tcf to continuous-type sandstone and shale plays in this area. Some of this potential is possibly included in the PGC estimate. US Atlantic offshore resource potential, all undiscovered, is estimated at 13.0 Tcf by the PGC, and 27.5 Tcf by the MMS. (Half-cycle economically recoverable gas at $3.52/Mcf is estimated to be 12.0 Tcf by the MMS). For the purpose of having a consistent data set I have used the PGC numbers in my evaluation. Of this resource potential in the Appalachian/Atlantic area only the onshore portion, or 61.4 Tcf is currently available.

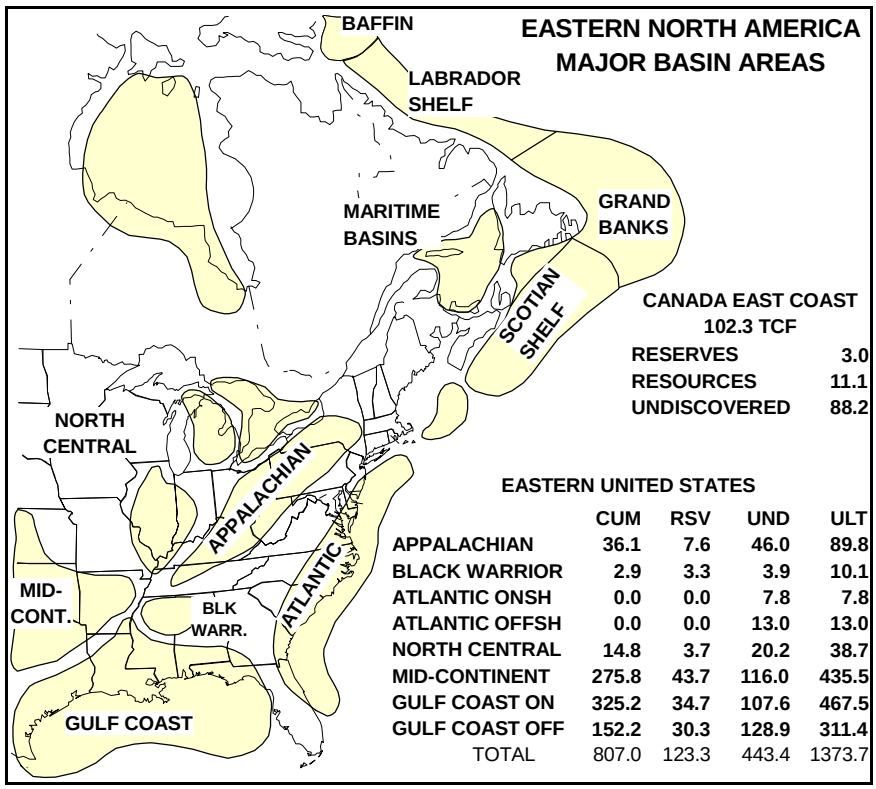

Figure 3 Major basin areas of eastern North America

The Canada East Coast potential is 102 Tcf, consisting of 14 Tcf of discovered reserves and resources, and undiscovered potential of 88 Tcf. Of this total 18.2 Tcf, representing only 3% of Canada's resource base, and 4.7% of the undiscovered, is attributed to the Scotian Shelf.

Figure 4 shows the East Coast area of Canada outlining the assessment areas used in the various resource assessments, published since 1984. Highlighted are two of the major discoveries of the area, the Hibernia oil field on the Grand Banks, and the Venture gas field of the Scotian Shelf. Areas in the Eastern Canada offshore which have discovered gas resources include, the Scotian Shelf with 5.8 Tcf, Jeanne d'Arc basin with 4.0 Tcf and the Labrador Shelf (immediately to the north of area shown) with 4.3 Tcf, for a total discovered resource of 14.1 Tcf. The Labrador Shelf is in a more hostile, higher cost environment of the East Coast, and this area is not expected to be considered for development in the near future, thus it is not included at this time. The ultimate gas potential for the area shown is estimated to be 66.3 Tcf, as summarized in figure 5.

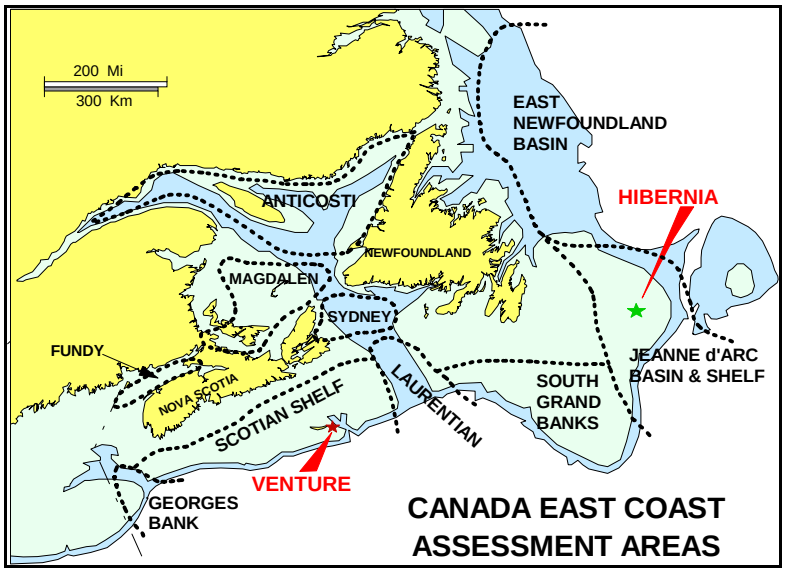

Figure 4 Canada Maritime region assessment areas

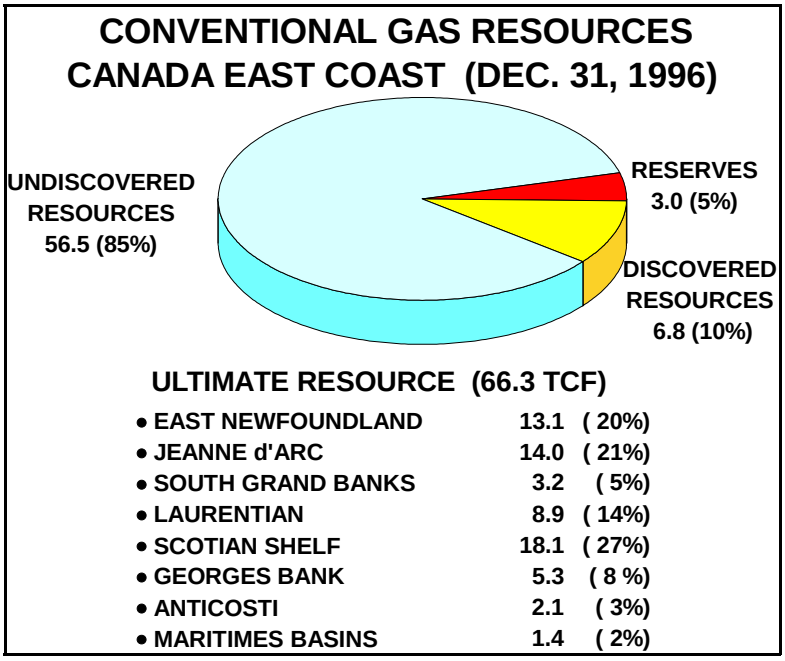

Figure 5 Conventional gas resources for Canada East Coast

Sable Offshore Energy Project (SOEP) reserves, of 3.0 Tcf, for the six fields scheduled for production are considered as discovered reserves. An additional 2.8 Tcf of discovered resources is in the remaining discoveries. The total potential for the Scotian Shelf (GSC Paper 88-19) is estimated to be 18.1 Tcf, with an undiscovered potential of 12.4 Tcf.

The Jeanne d'Arc basin has discovered resources of 4.0 Tcf, and undiscovered resources of 10.0 Tcf. Much of the gas to date is associated and dissolved gas from the oil pools of the Jeanne d'arc basin. The undiscovered potential is expected to be both non-associated and associated. The East Newfoundland basin and south Grand Banks have undiscovered potential of 16.3 Tcf.

Figure 6 shows the projected production for Canada based on the demand presented in the Canada Energy Outlook 1996 - 2020 report by the Energy Resources Sector of Natural Resources Canada. This report shows domestic demand of 2.5 Tcf/year in 1996 increasing to 3.3 Tcf by 2020 and net exports of 2.7 Tcf in 1996 increasing to 4 Tcf in 2020. The two lines show the percentage of the total remaining resource base that is left, based on the current resource estimates. By 2020 only 24.6 Tcf (14%) of the remaining potential would be left if all production came from the producing areas. Adding the east Coast resources of 66.3 Tcf, would leave a total of 38% (90.9 Tcf) of the resource base for the future.

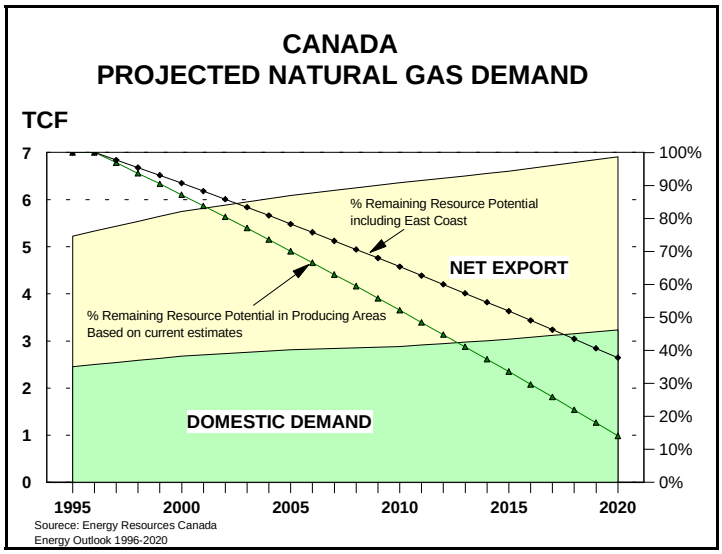

Figure 6 Natural gas demand for Canada

Figure 7 is a supply curve based on the demand shown in figure 6. Productive capacity in currently producing pools is declining and new discoveries, and/or production from new areas will become increasingly important in the years ahead. The curve presented is not based on any productive capacity study but rather considers available gas volumes and reserves to production ratios. The supply curve from 1996 forward contains 60.9 Tcf from established reserves, essentially depleting this reserve, 72.1 Tcf from new discoveries and 16.8 Tcf from the frontier (including SOEP). The contribution by the SOEP projected production is shown. Although it may appear as a small sliver on this chart, it is a most significant part of the overall North American gas supply.

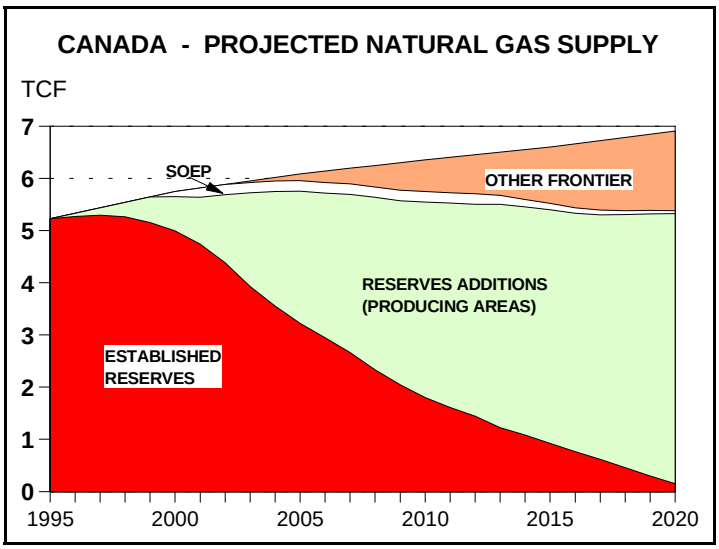

Figure 7 Canadian natural gas supply by source

With the increasing demand for natural gas in the United States and Canada, new sources of supply will be needed in the future. Unconventional gas and gas from the Frontiers is going to be needed. One of the more accessible of frontier gas resources is that of the east coast of Canada, and this area should play an increasingly important role in the years to come.

TABLE 2 **CANADA - MARKETABLE GAS (BILLION CUBIC FEET)**

December 31, 1996	CUMUL. PROD.	REM RESERVES	DISCOV. RESOURCES	UNDISCOV. RESOURCES	ULTIMATE RESOURCE
WESTERN CANADA SEDIMENTARY BASIN					
ALBERTA	81,829	48,913	8,589	64,279	203,612
BRITISH COLUMBIA	11,183	8,618	1,917	28,812	50,530
SASKATCHEWAN	3,549	2,769	177	2,236	8,731
SOUTH YT & NWT	414	241	71	5,966	6,693
TOTAL WCSB	96,976	60,541	10,755	101,294	269,565
ONTARIO/QUEBEC	1,136	426	0	1,420	2,981
TOTAL PRODUCING AREAS	**98,111**	**60,967**	**10,755**	**102,714**	**272,547**
FRONTIER					
EAST COAST					
SCOTIAN BASIN	0	2,992	2,793	12,402	18,187
JEANNE D'ARC BASIN/SHELF	0	0	4,036	9,984	14,020
E NEWFOUNDLAND BASIN				13,133	13,133
SOUTH GRAND BANKS				3,194	3,194
ANTICOSTI				2,130	2,130
MARITIMES BASINS				1,420	1,420
LAURENTIAN BASIN				8,873	8,873
GEORGES BANK				5,324	5,324
NOVA SCOTIA GRAND BANKS	**0**	**2,992**	**6,829**	**56,460**	**66,281**
LABRADOR SHELF	0	0	4,245	22,198	26,443
BAFFIN/LANCASTER	0	0	0	9,583	9,583
TOTAL BAFFIN/LABRADOR	0	0	4,245	31,781	36,026
TOTAL EAST COAST	0	2,992	11,074	88,241	102,307
OTHER FRONTIER					
MACKENZIE/BEAUFORT	0	0	8,909	55,583	64,492
ARCTIC ISLANDS	0	0	14,780	87,655	102,435
MAINLAND TERRITORIES			674	9,832	10,506
BC OFFSHORE/INTERMONTANE				39,772	39,772
HUDSON BAY				3,123	3,123
TOTAL OTHER	0	0	24,363	195,965	220,328
TOTAL FRONTIER	**0**	**2,992**	**35,437**	**284,206**	**322,635**
TOTAL CANADA	**98,111**	**63,959**	**46,192**	**386,920**	**595,182**

UNITED STATES CONVENTIONAL NATURAL GAS RESOURCES (BCF)

December 31, 1996	96PROD	REM RESERVES	CUMUL PROD	PGC EST. UNDISCOV	ULTIMATE
APPALACHIAN BASIN	470	7,628	36,117	46,050	89,795
ATLANTIC OFFSHORE	0	0	0	13,000	13,000
ATLANTIC ONSHORE	0	0	0	7,800	7,800
BLACK WARRIOR BASIN	248	3,297	2,944	3,850	10,091
GULF COAST ONSHORE	4,958	34,667	325,160	107,644	467,471
GULF COAST OFFSHORE	5,384	30,280	152,217	128,938	311,435
MID-CONTINENT	4,900	43,718	275,762	115,979	435,459
NORTH CENTRAL	354	3,706	14,793	20,155	38,654
PACIFIC OFFSHORE	58	1,315	2,568	15,920	19,803
PACIFIC ONSHORE	220	2,146	29,519	15,150	46,815
ROCKY MOUNTAINS	2,746	39,095	60,986	123,899	223,980
TOTAL LOWER 48	**19,337**	**165,851**	**900,066**	**598,385**	**1,664,302**
ALASKA	446	9,296	8,126	143,050	160,472
TOTAL USA	**19,783**	**175,147**	**908,192**	**741,435**	**1,824,774**
TOTAL CANADA/USA	**1,006,303**	**239,106**	**954,384**	**1,128,355**	**2,419,956**