

The International Outlook: Natural Gas Supply from a Canadian Perspective

Natural Gas Technologies II
Perspectives on Natural Gas Supply
Phoenix, Arizona
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Natural Resources
Canada

GEOLOGICAL SURVEY
OF CANADA
CALGARY

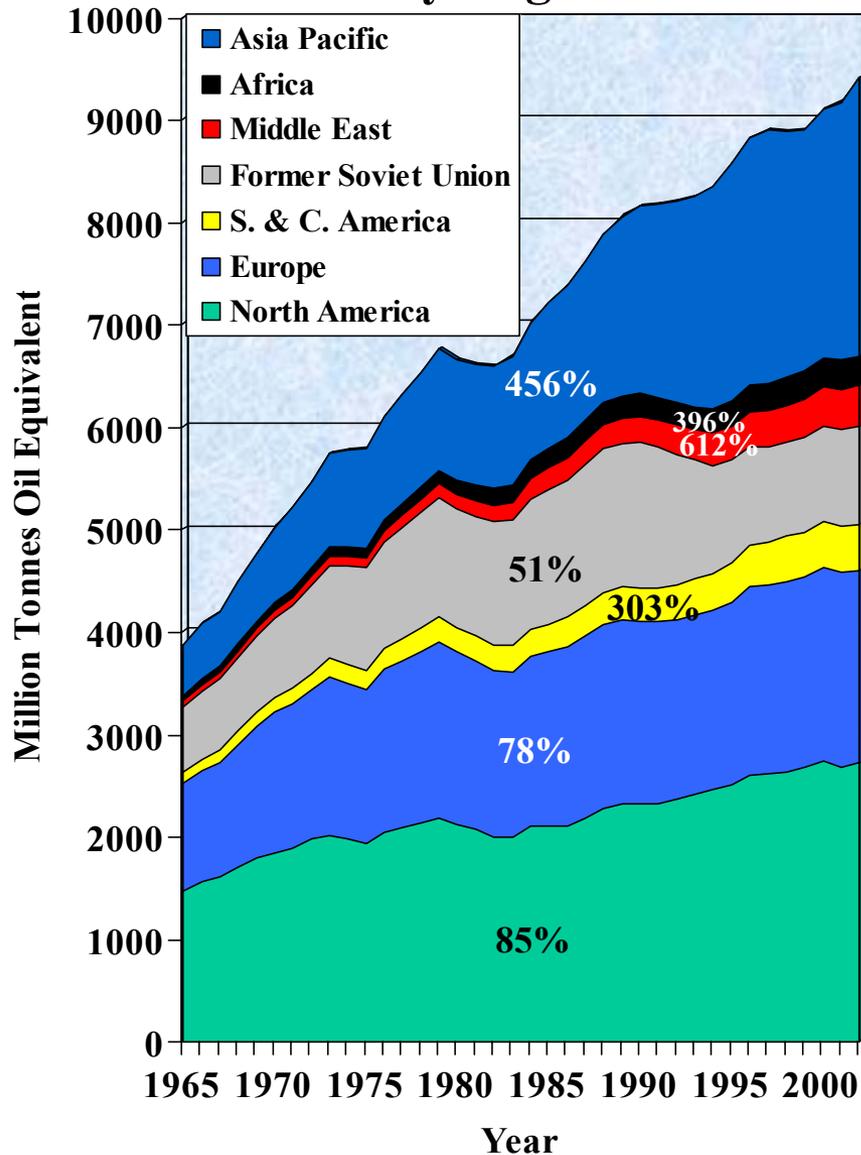


Ressources naturelles
Canada

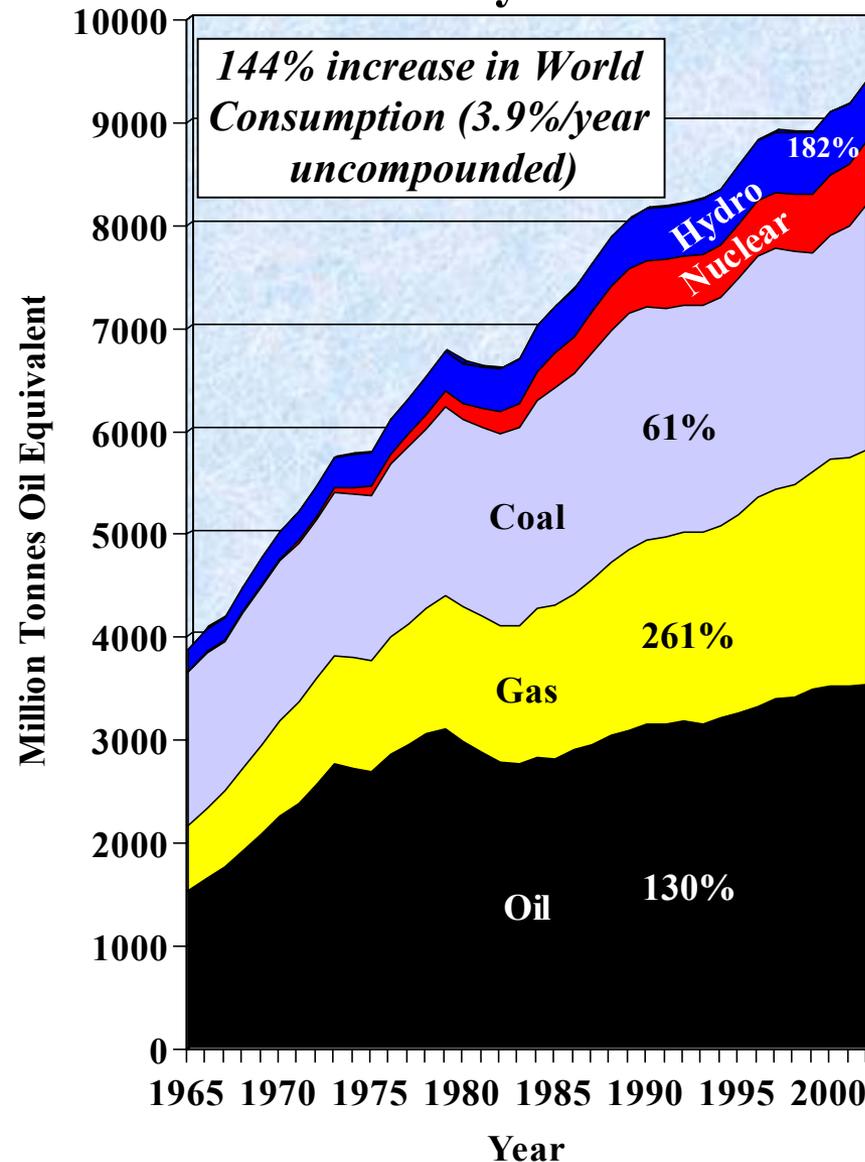
COMMISSION GÉOLOGIQUE
DU CANADA
CALGARY

World Primary Energy Consumption: 1965-2002

By Region



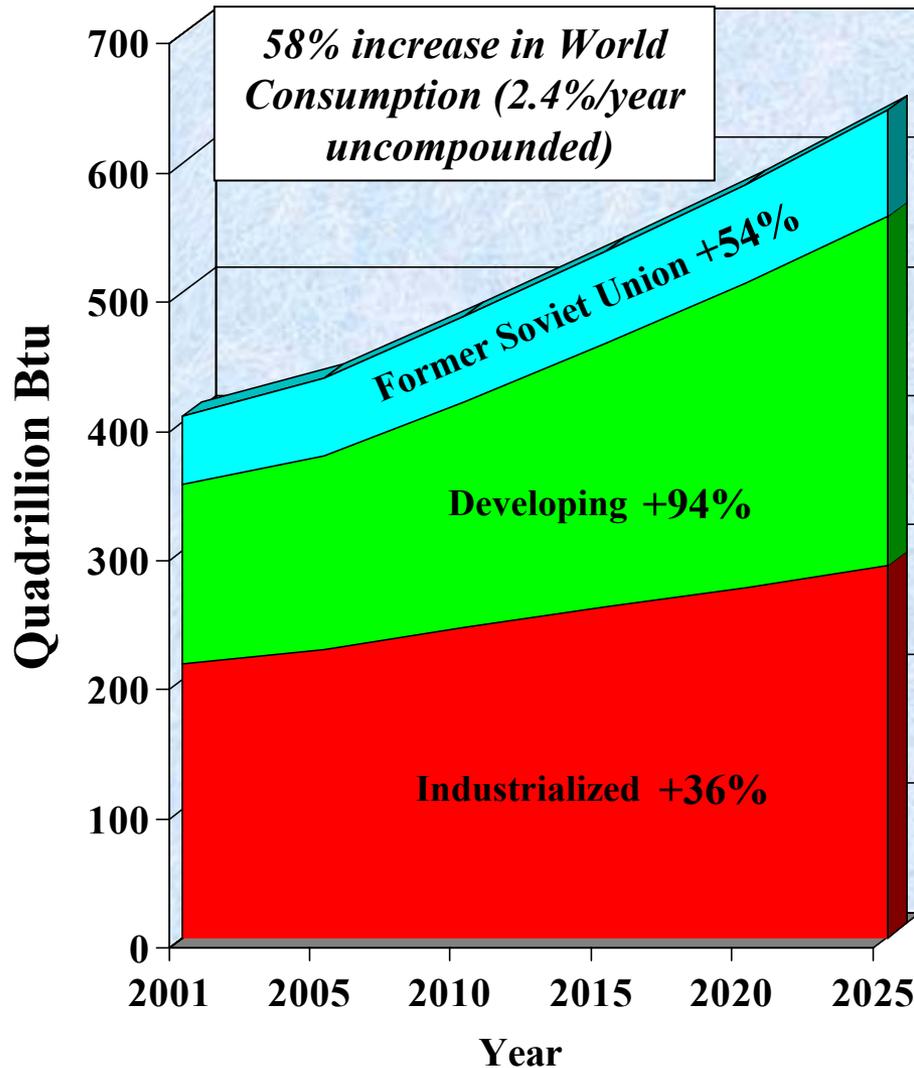
By Fuel



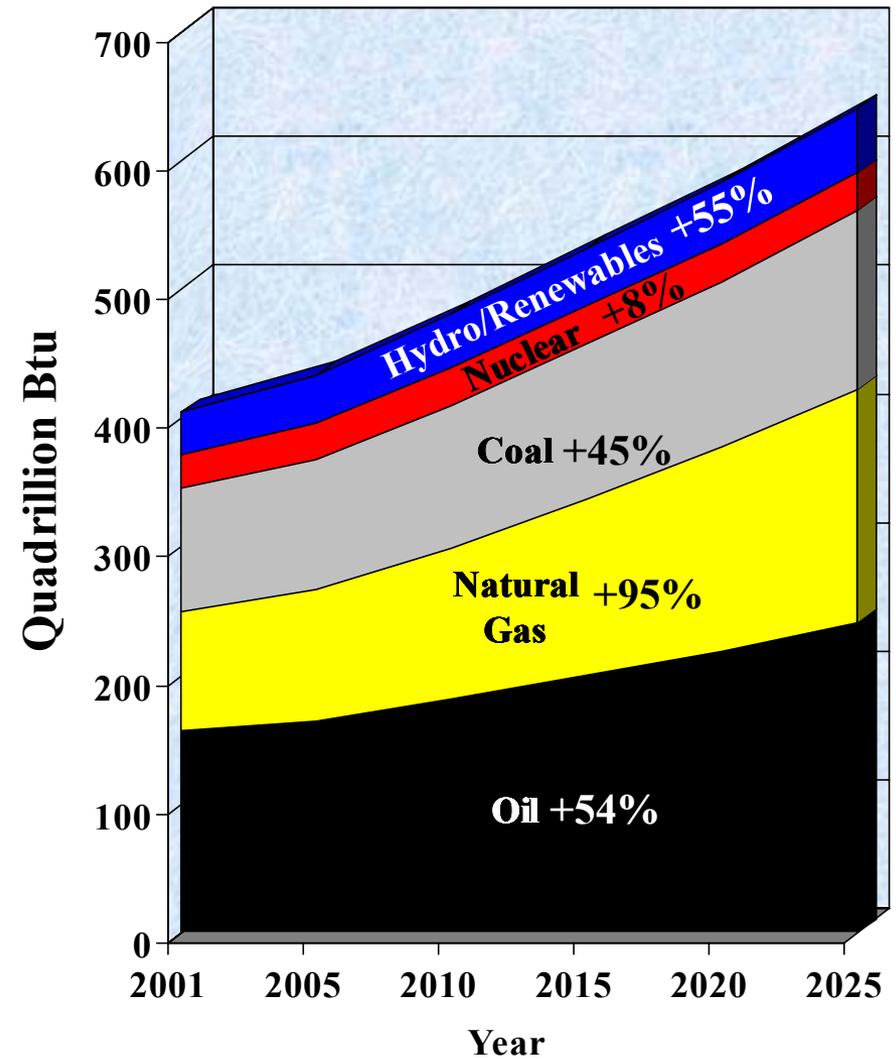
Highest growth in 2002 = Asia Pacific 7.9%; Coal 6.9% (data from BP Statistical Review of World Energy, 2003)

Forecast Growth In World Energy Consumption, 2001-2025 (EIA, 2003, Reference Economic Case)

By Region



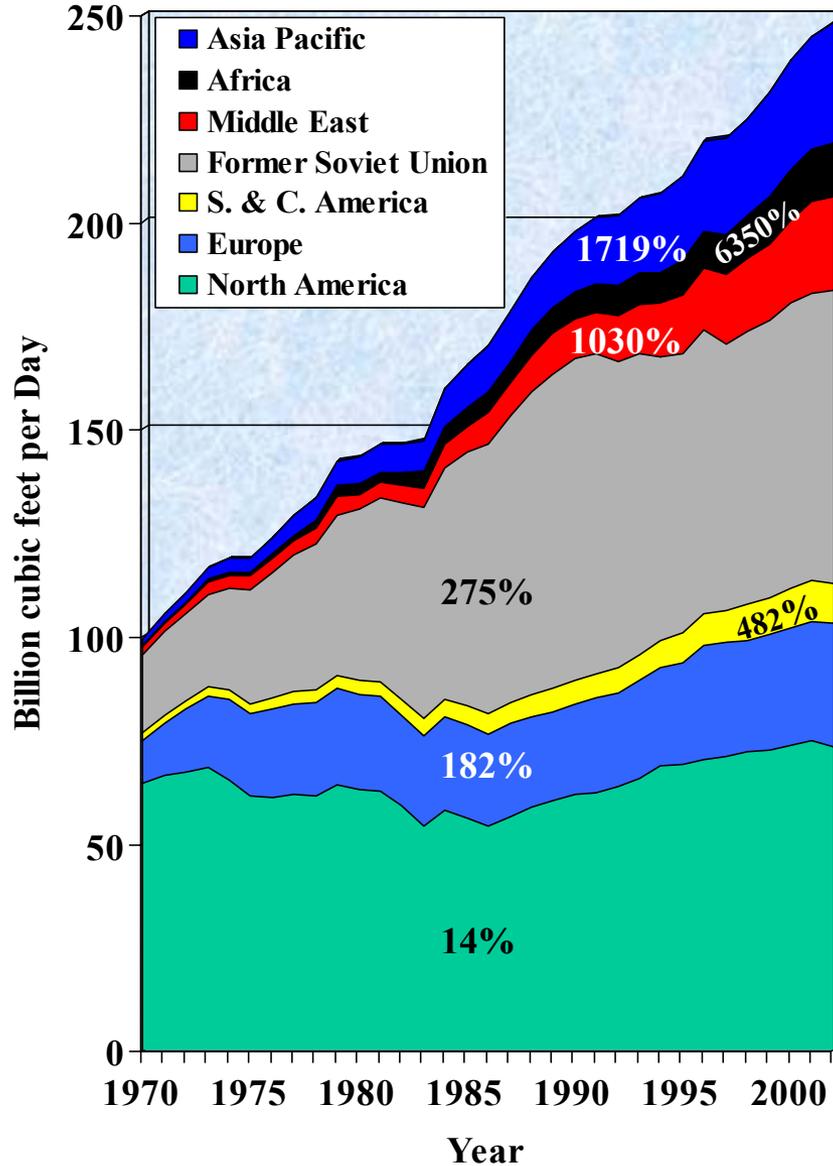
By Fuel



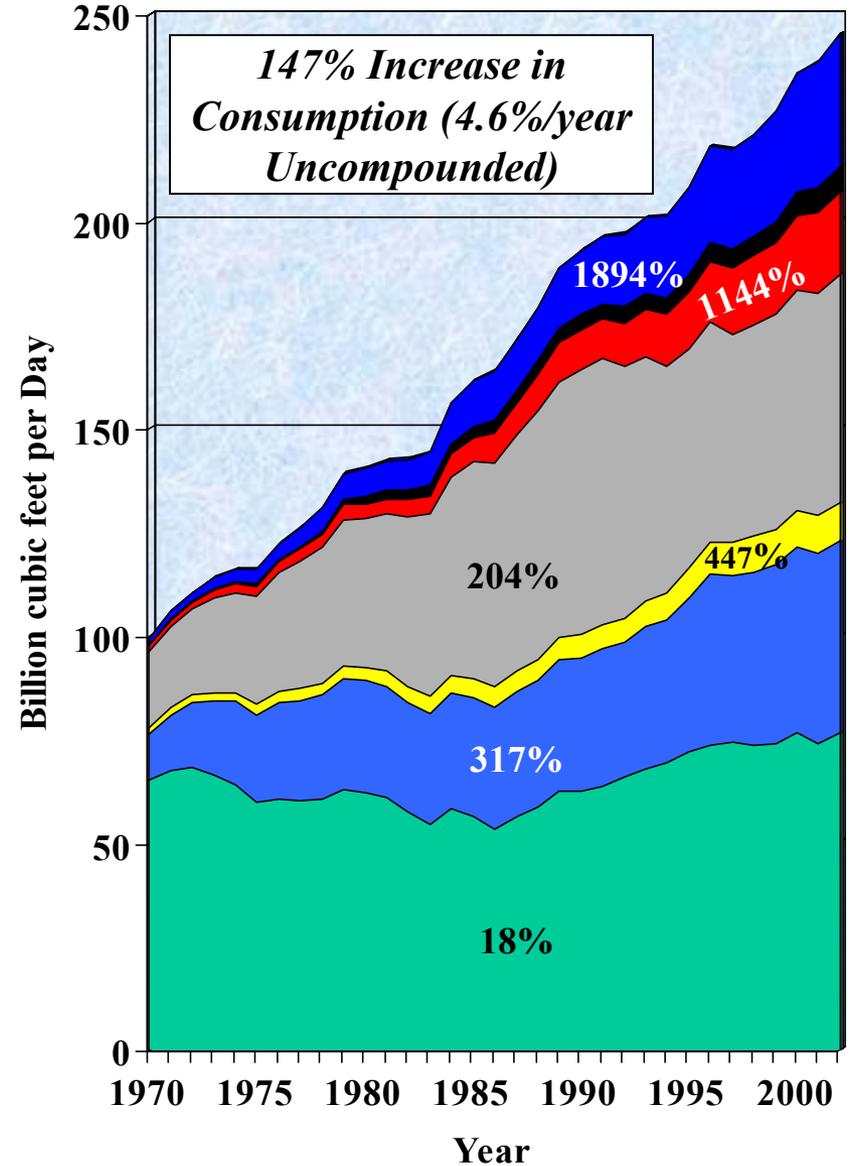
(data from Energy Information Administration International Energy Outlook, 2003)

World Gas Production and Consumption: 1970-2002

Production

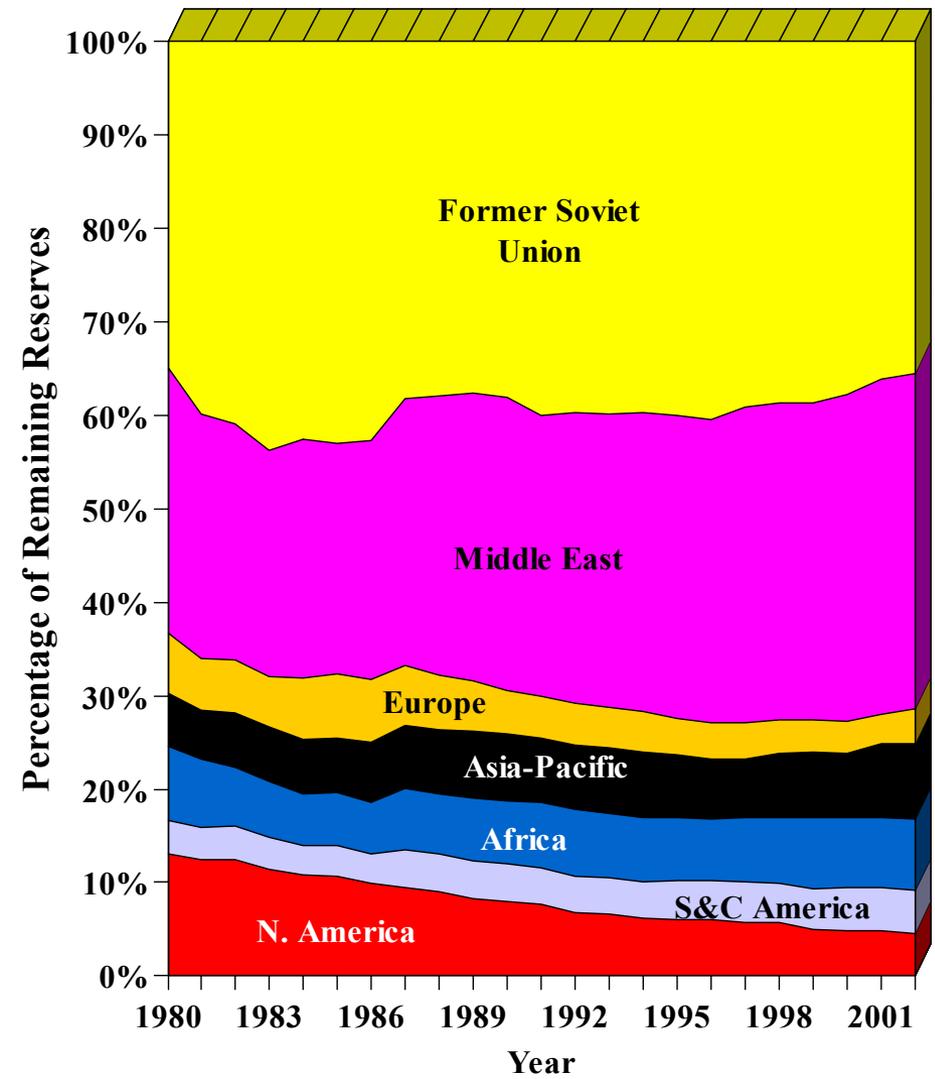
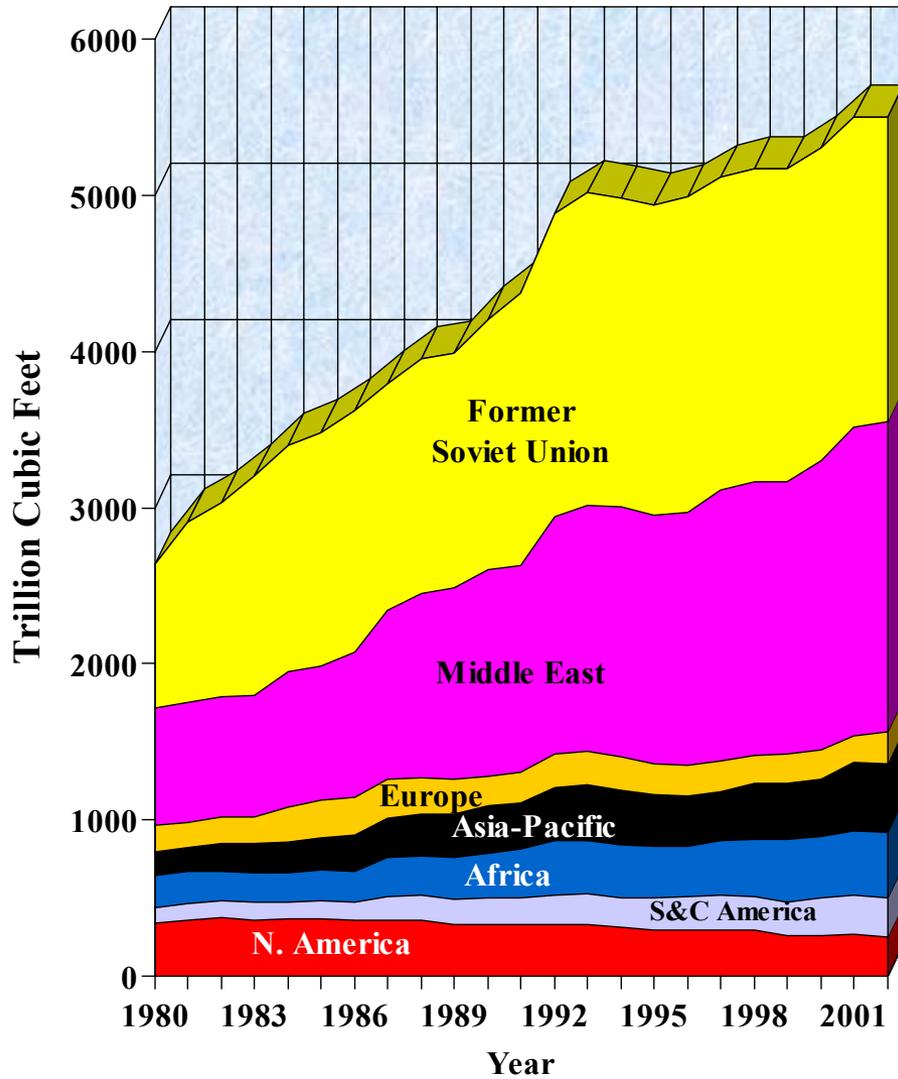


Consumption



(data from BP Statistical Review of World Energy, 2003)

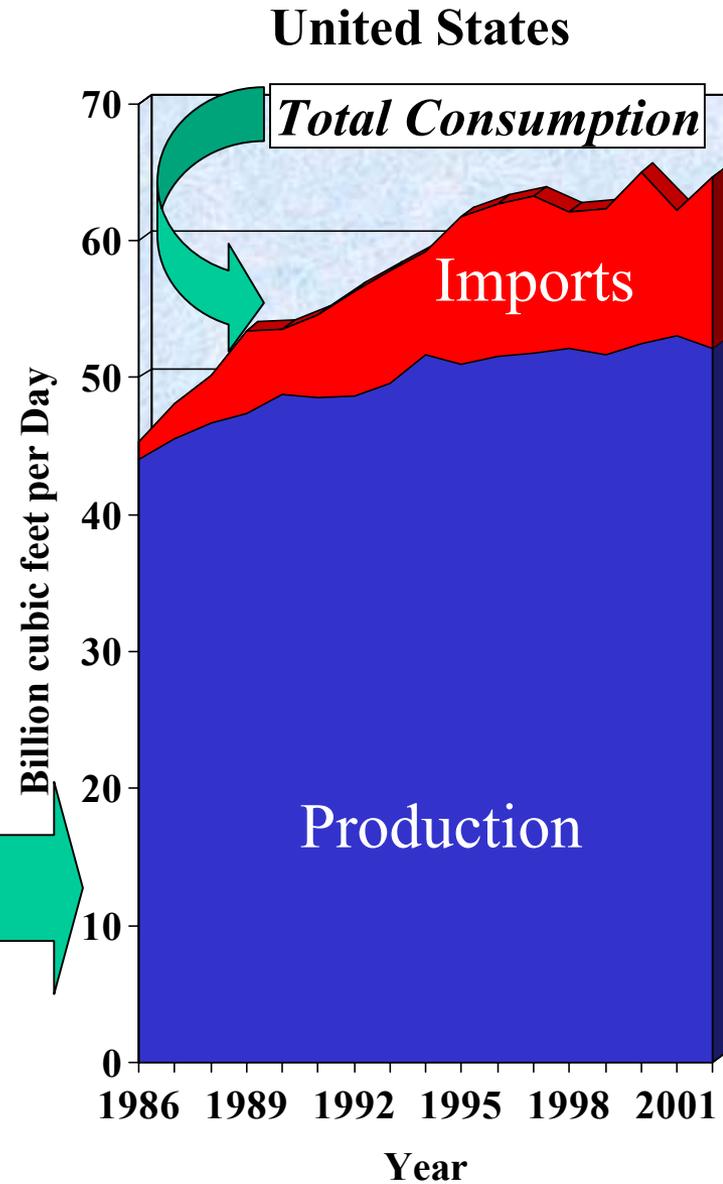
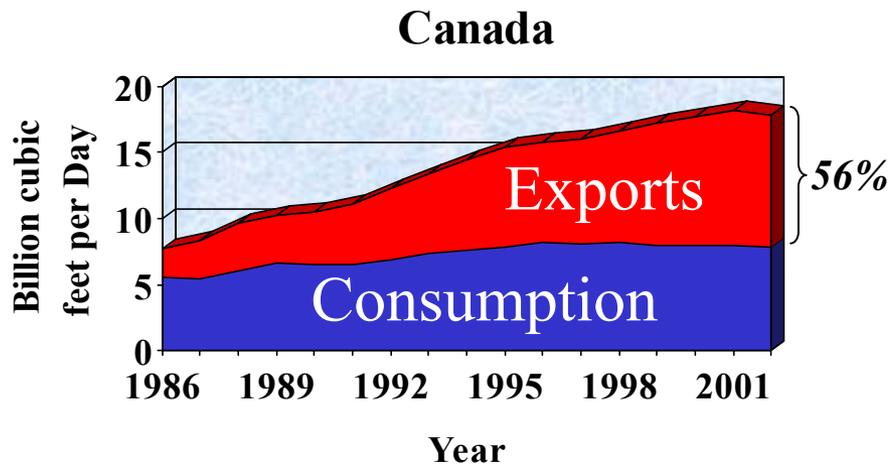
World Gas Reserves: 1980-2002



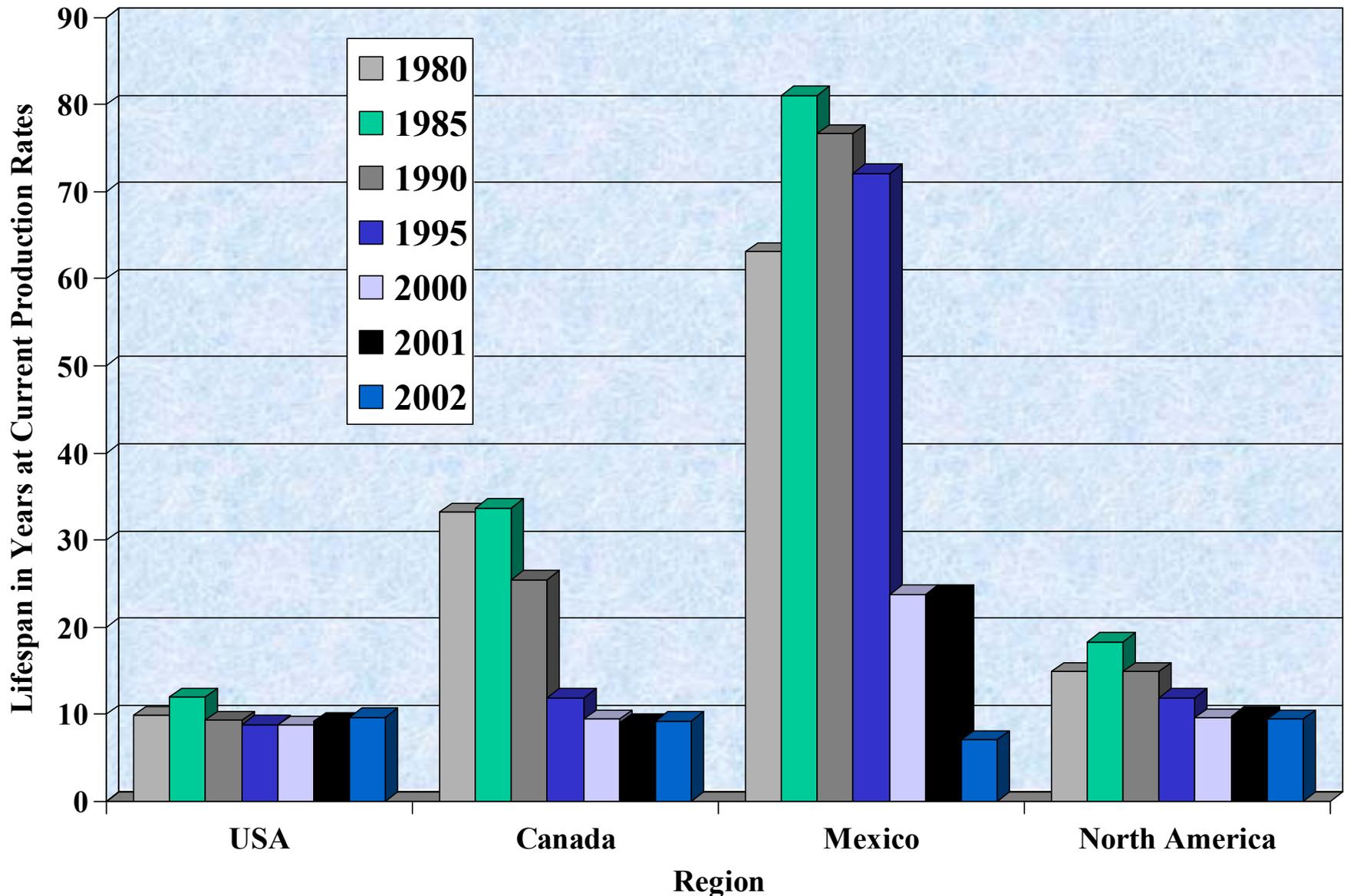
(data from BP Statistical Review of World Energy, 2003)

North American Gas Production and Movements: 1986-2002

*Canada:
131% increase
in production
1986-2002*



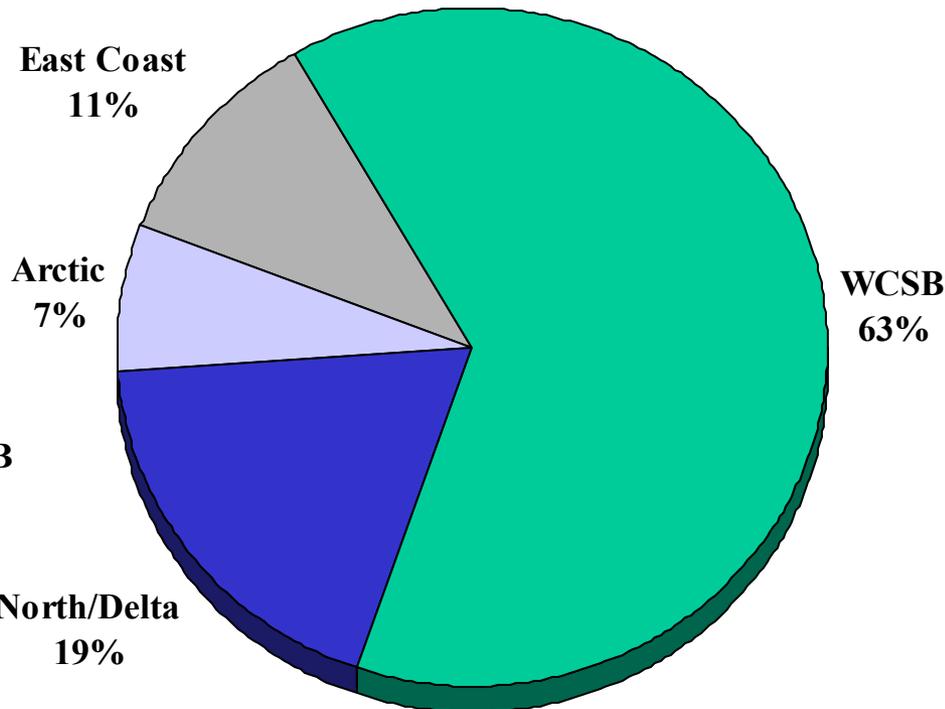
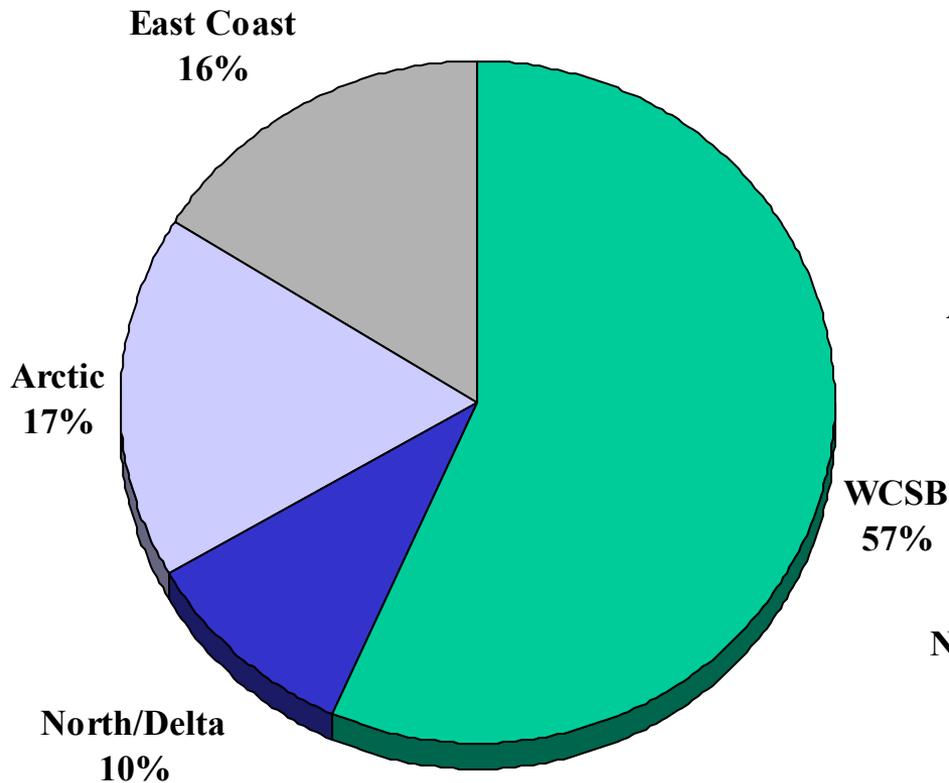
North American Gas Reserve/Production Ratio: 1980 - 2002



(data from BP Statistical Review of World Energy, 2003)

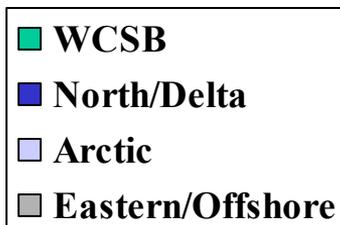
Remaining *Discovered* Nominal Marketable Gas in Canada

Remaining *Undiscovered* Nominal Marketable Gas in Canada

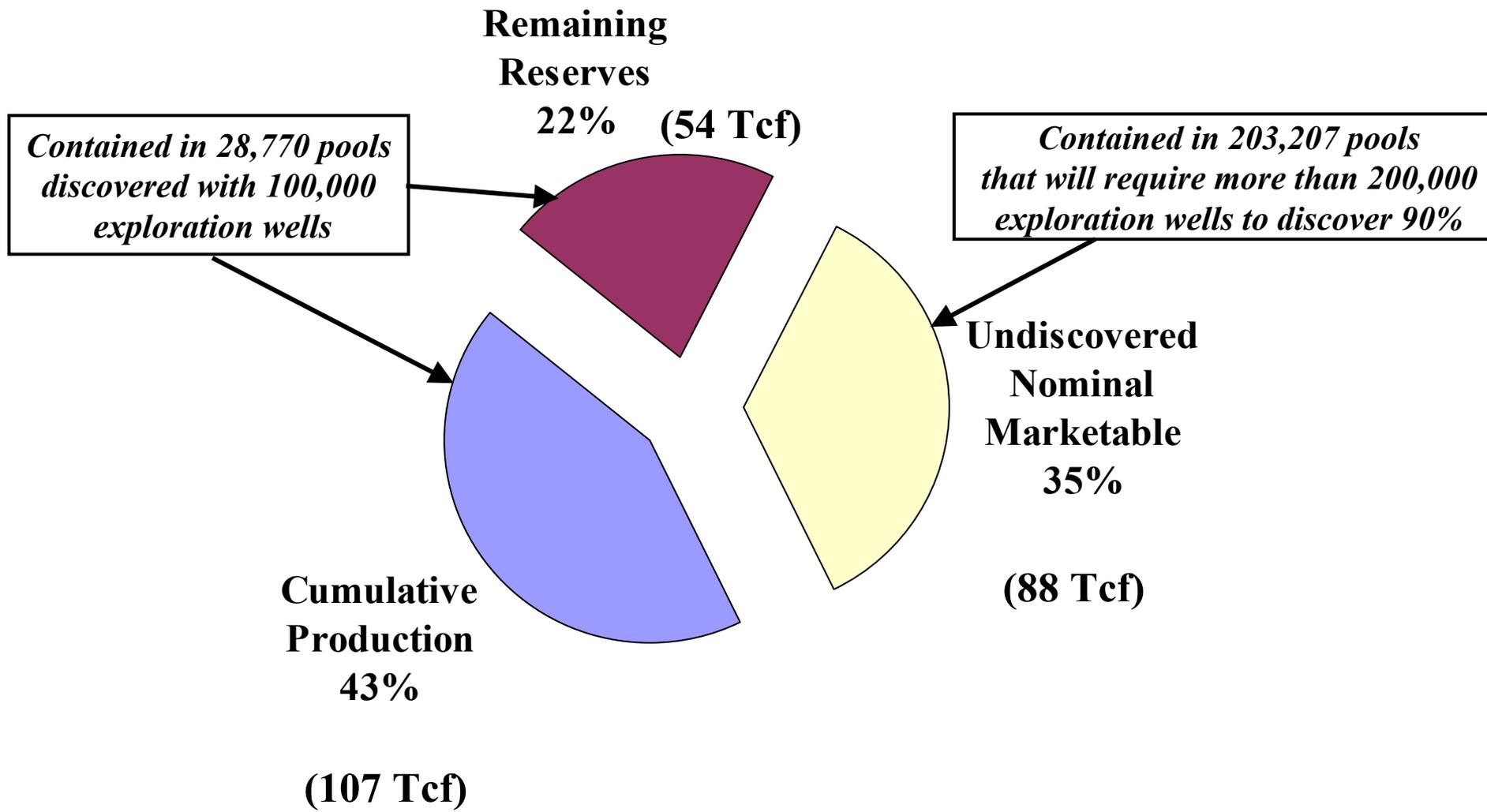


95.8 Tcf

137.8 Tcf



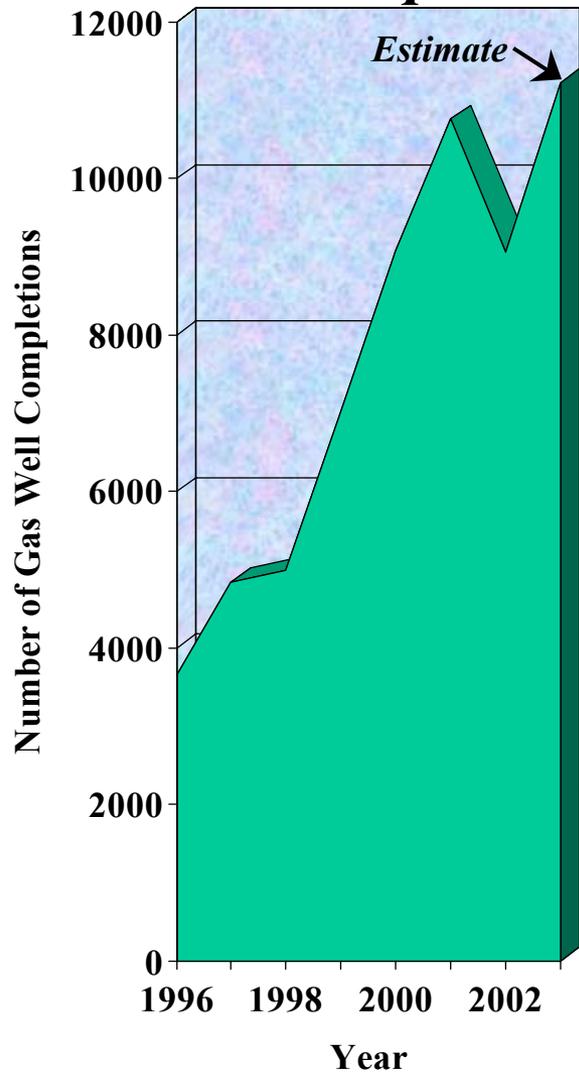
Produced, Established and Nominal Marketable Natural Gas in the WCSB (Tcf) - Canadian Gas Potential Committee, 2001



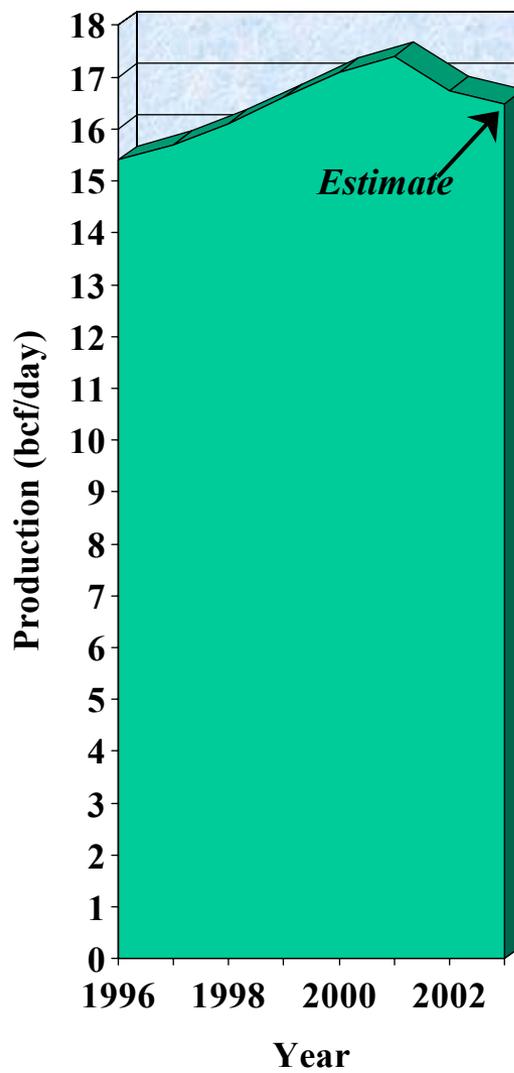
(data from Canadian Gas Potential Committee, 2001)

Canada's Exploration Treadmill – more and more drilling to find less and less gas

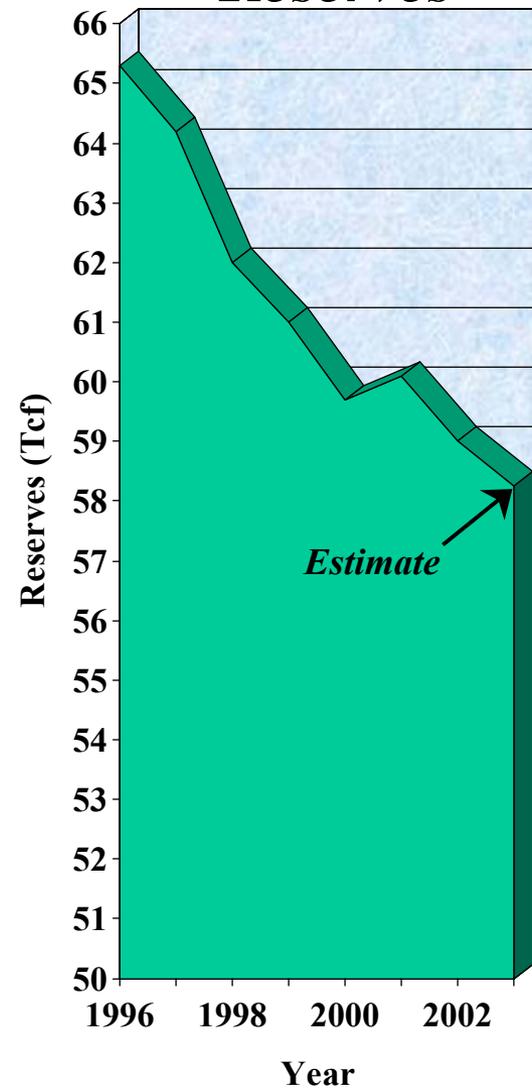
Well Completions



Production



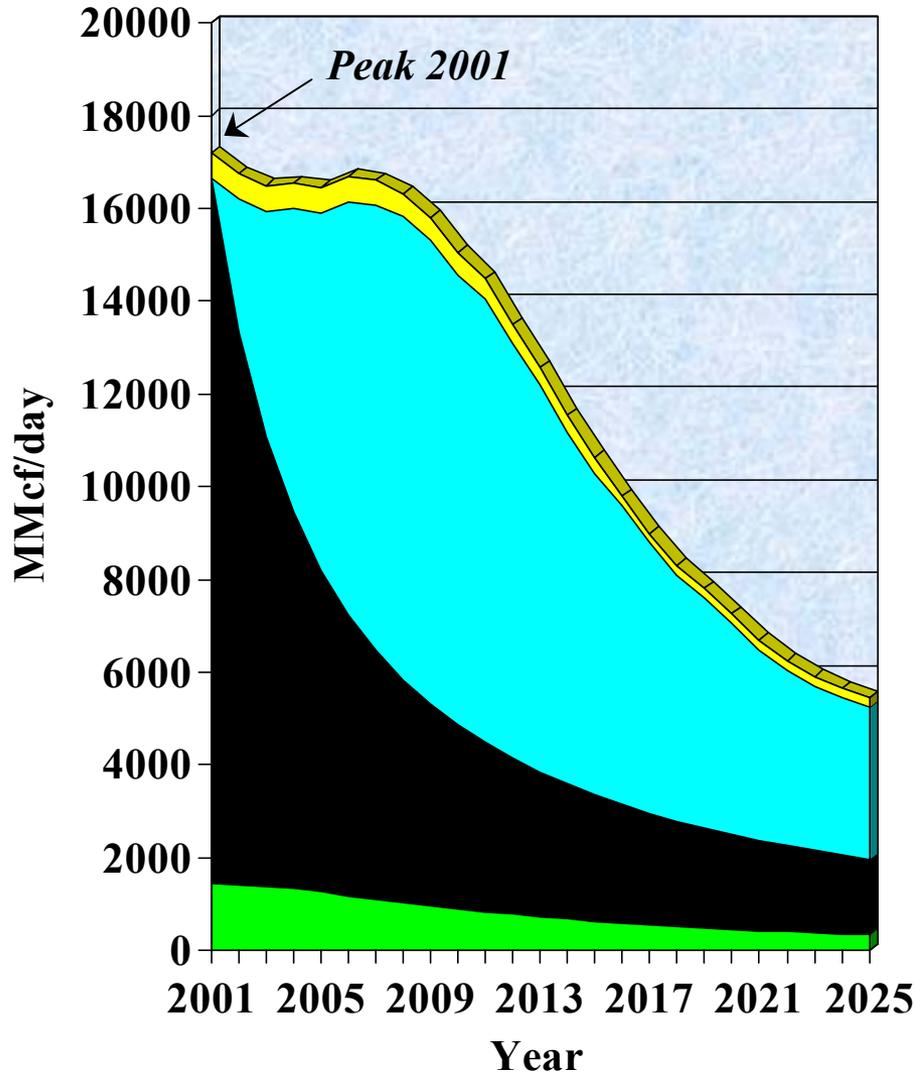
Reserves



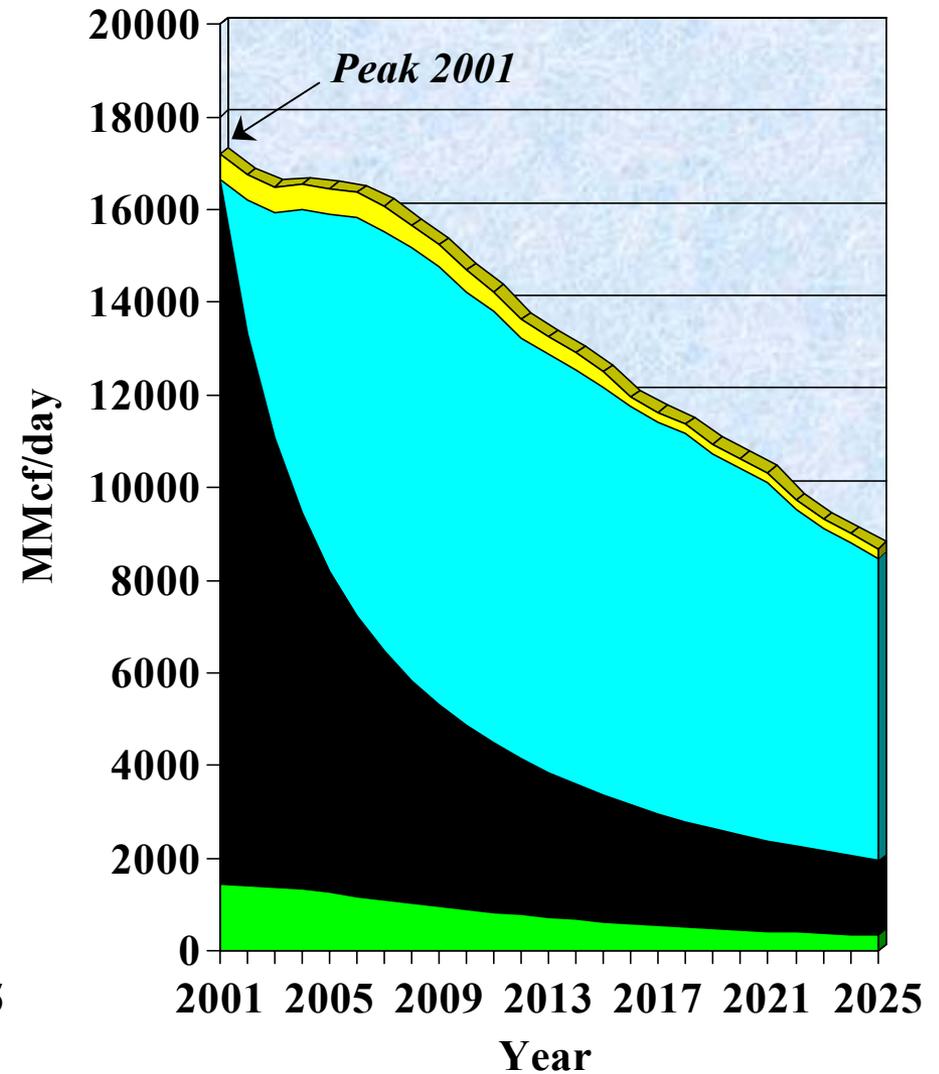
Canadian Association of Petroleum Producers 2003 (1996-2002 well completions; 1996-2001 production; 1996-2002 reserves); National Energy Board, July, 2003 (2002 production, 2003 estimate); Petroleum Services Association of Canada, 2003 (2003 drilling)

NEB, July, 2003, Deliverability Scenarios from Existing Gas Sources

Supply Push Scenario



Techno-Vert Scenario



■ WCSB Solution

■ WCSB Existing Gas

■ WCSB Additions

■ Sable

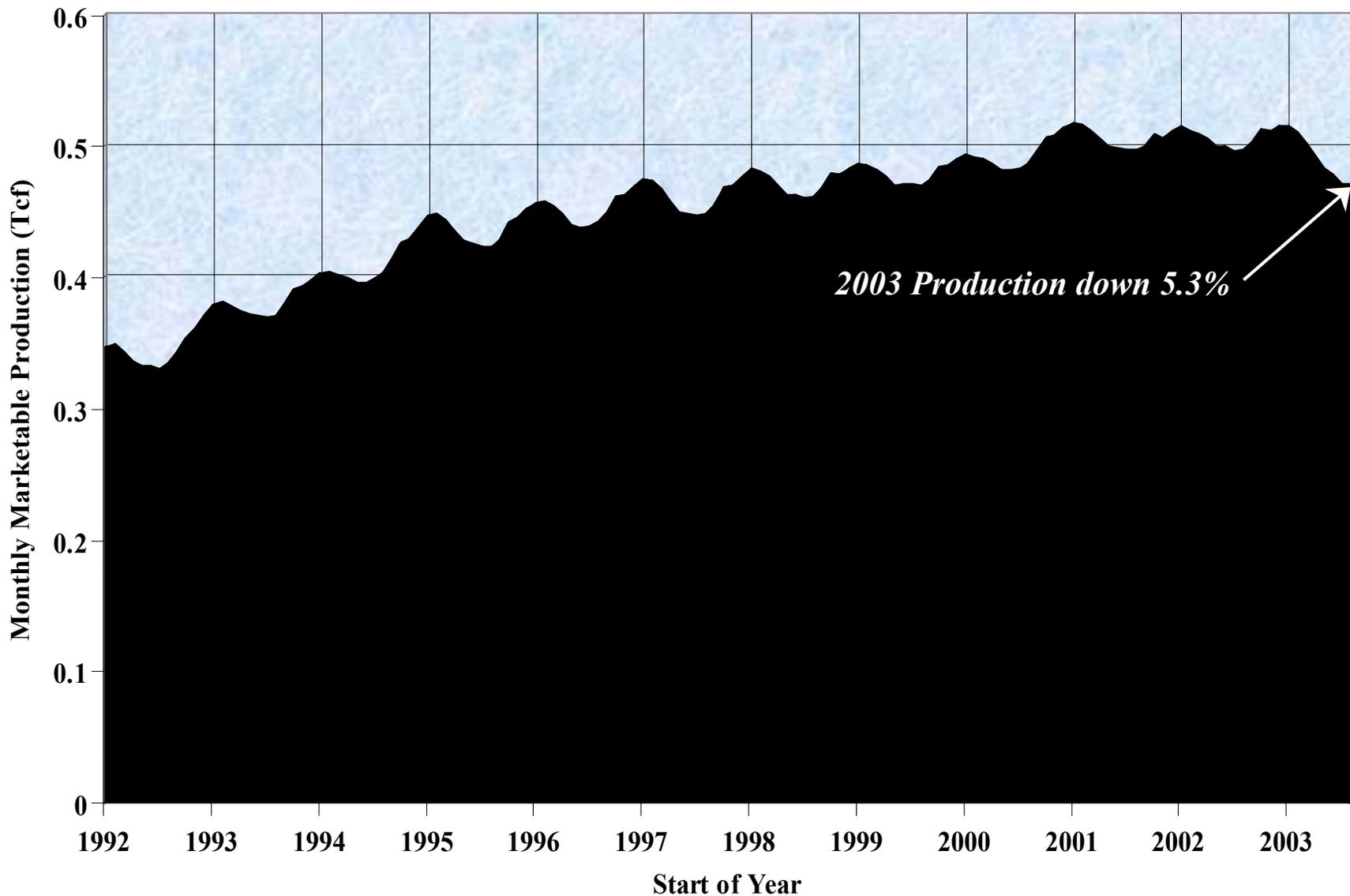
Productivity Assumptions of NEB Scenarios for the Western Canada Sedimentary Basin

- **WCSB drilling rates will be sustained at the record levels of 2001** until 75% of the ultimate recoverable resource has been produced.
- **Initial productivity of new wells will remain at current levels** Initial productivity has declined from an average 700 mcf/day in 1997 to 350 mcf/day in 2003 – this trend may continue in the future.
- **Decline rates in new wells will remain at current levels** First year decline rates have increased from <20% in 1990 to nearly 35% in 2000 - this trend may continue in the future.

The overall decline rate of the WCSB has increased from 13% in 1992 to 23% in 2002 – this means 3.2 Bcf/day of production must be replaced each year to keep production flat, which hasn't happened since 2001. NEB (December, 2003) expects production to decline by 3% through 2005.

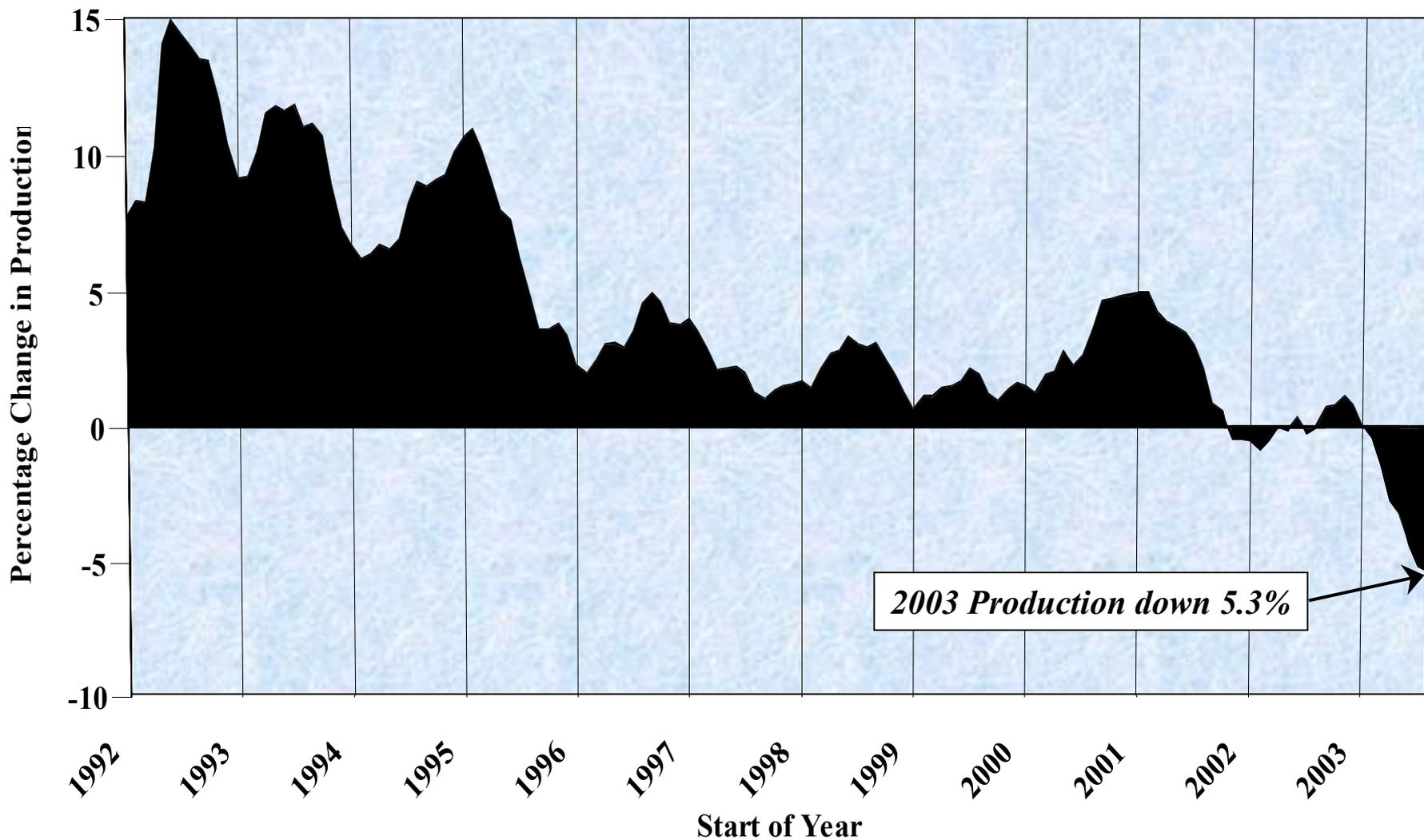
(assumptions included in National Energy Board Report of July, 2003, and data provided in December, 2003, National Energy Board Report)

Canadian Marketable Gas Production by Month, 1992-2003 (7 month moving average)



(Source of data Statistics Canada, 2004)

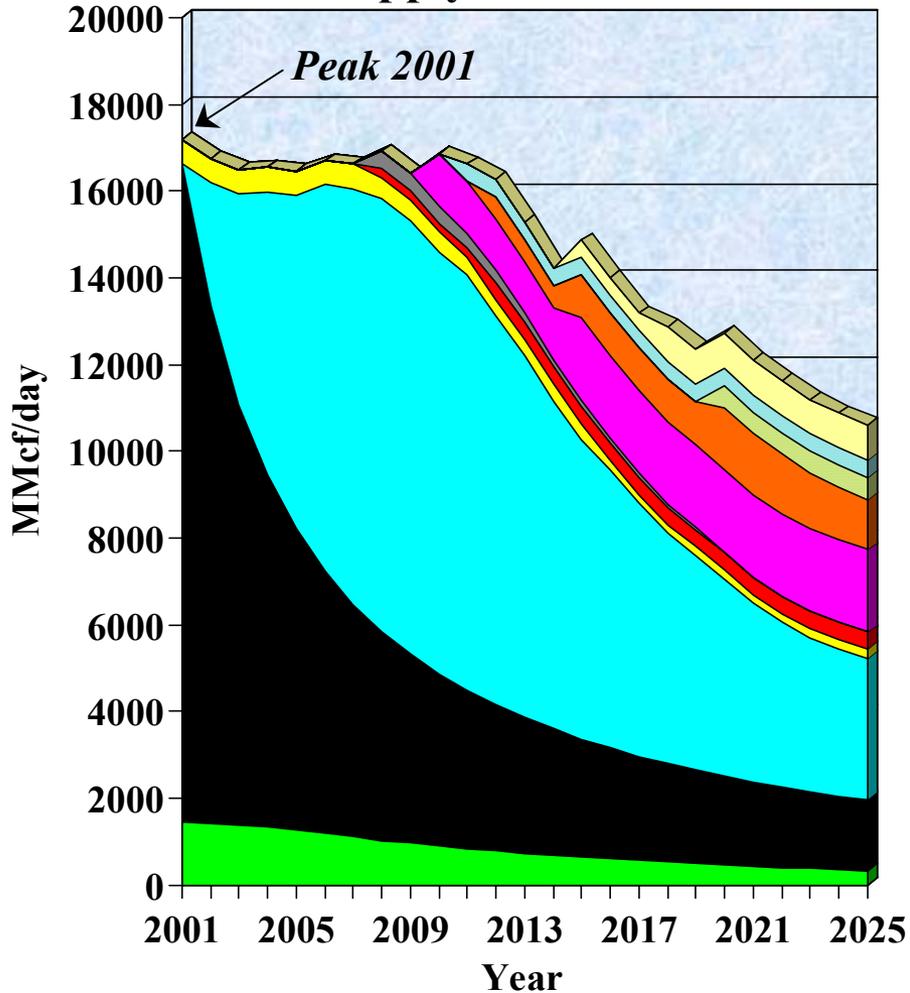
Year-over-Year change in Canada's Marketable Gas Production 1994-2003 (7 month moving average)



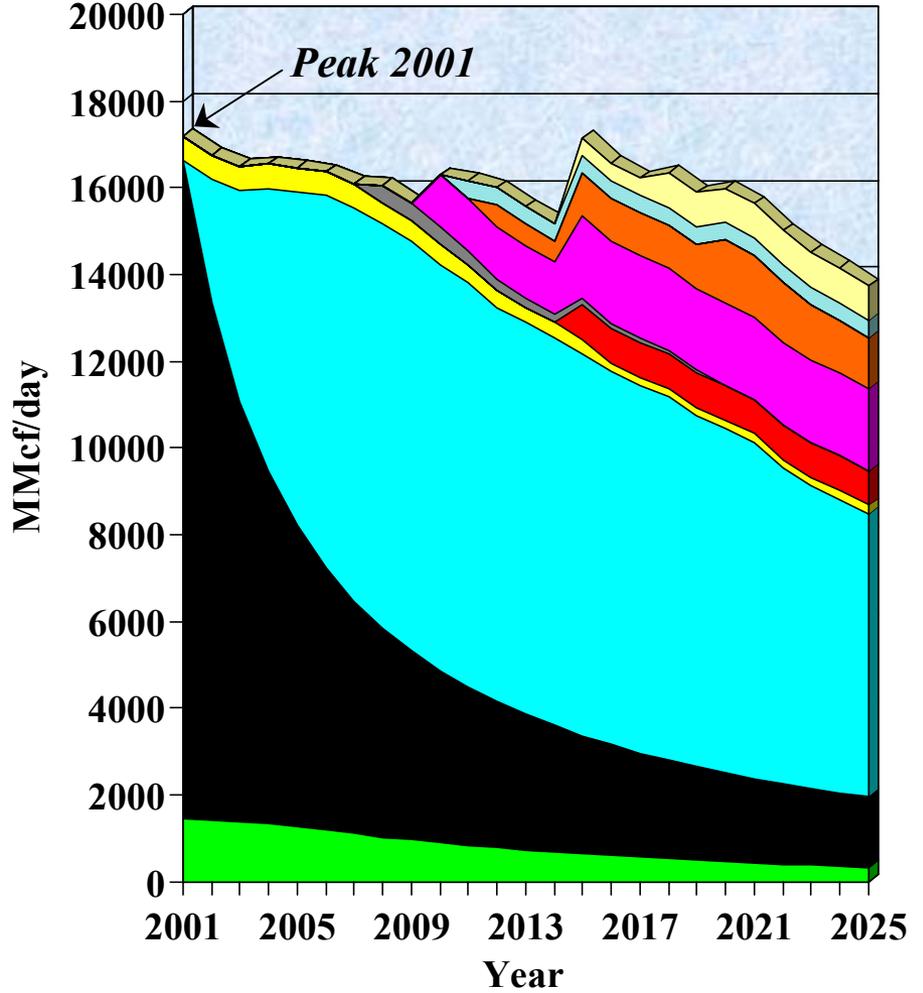
(Source of data Statistics Canada, 2004)

NEB, July, 2003, Deliverability Scenarios from Existing and Proposed Conventional Gas Sources

Supply Push Scenario

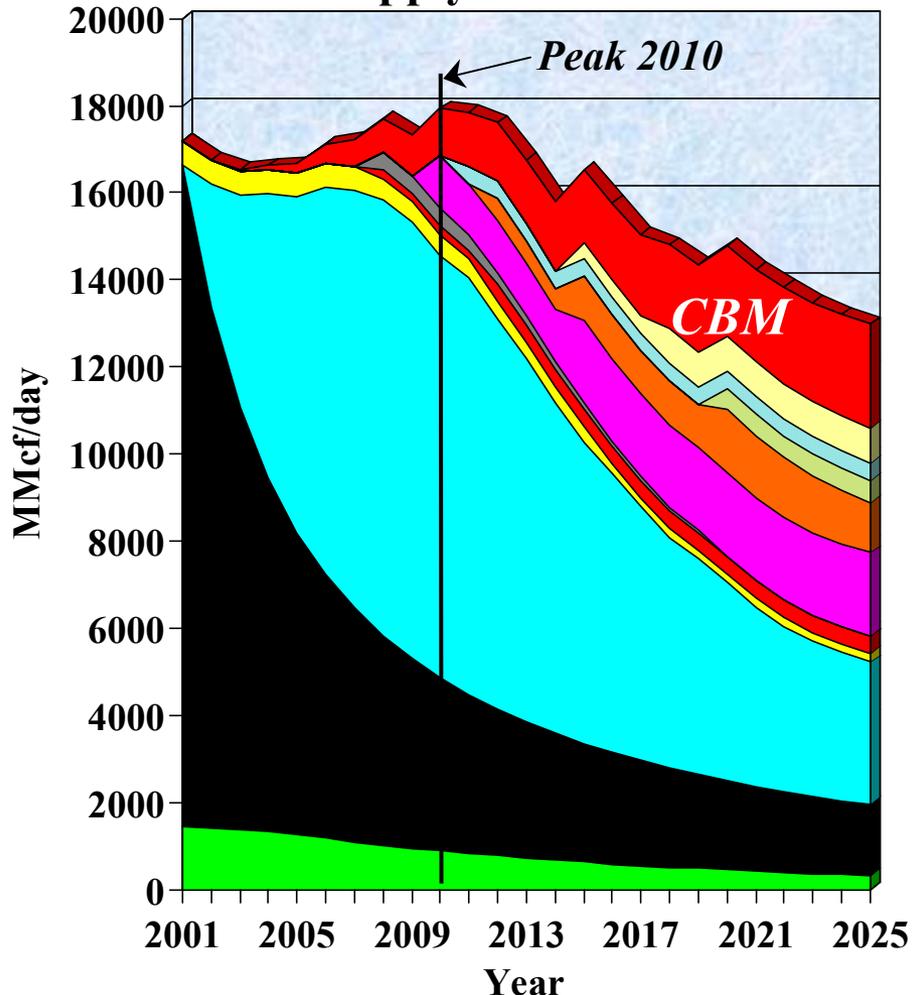


Techno-Vert Scenario

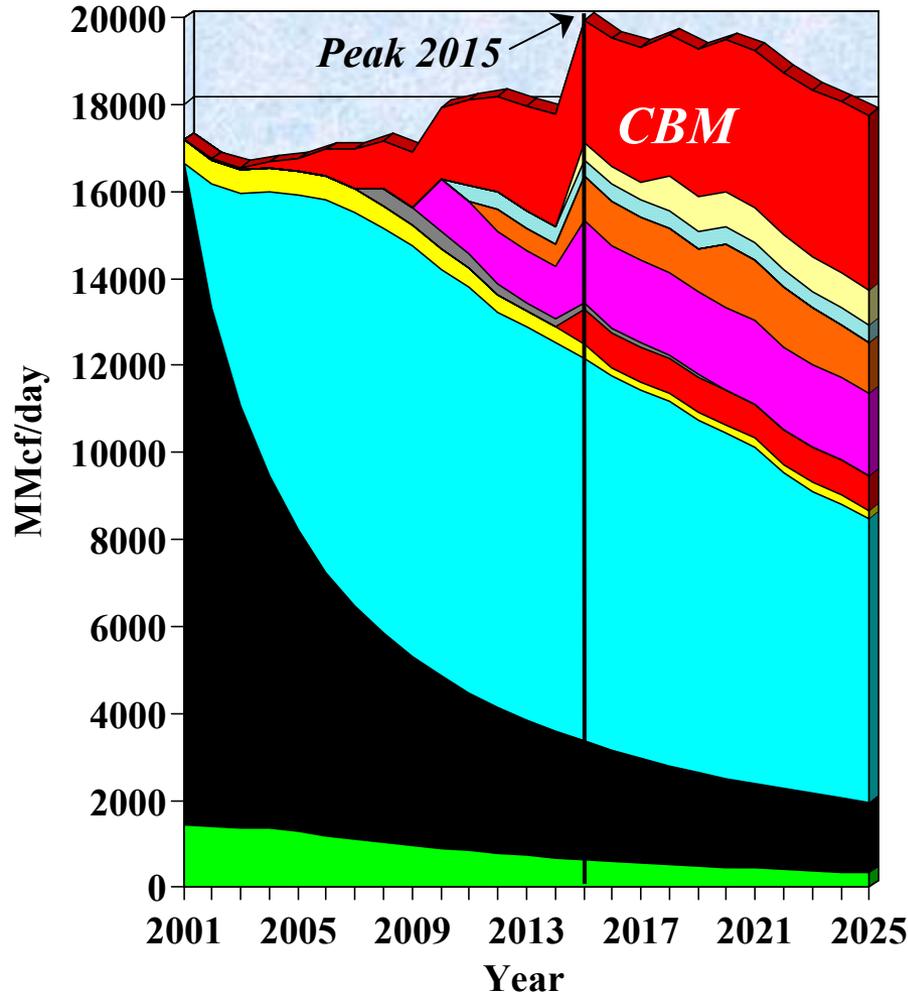


NEB, July, 2003, Deliverability Scenarios from Existing and Proposed Conventional Gas Sources Including Coalbed Methane

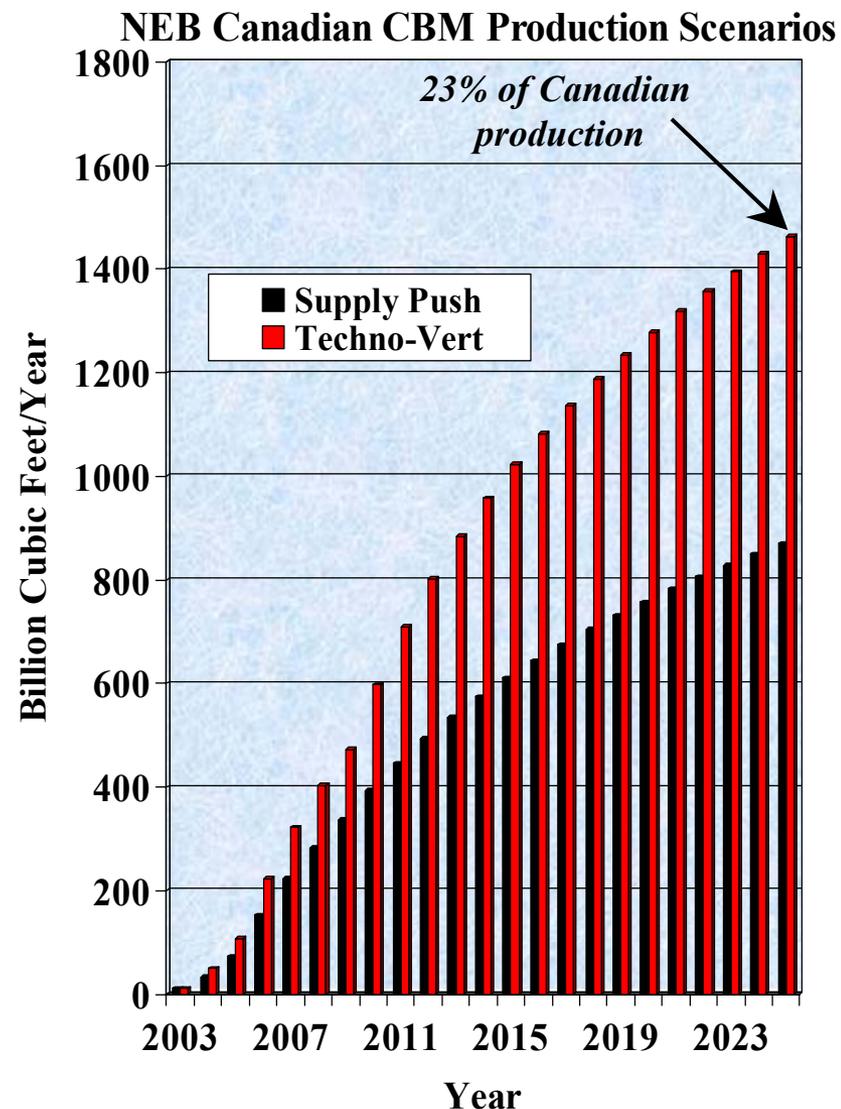
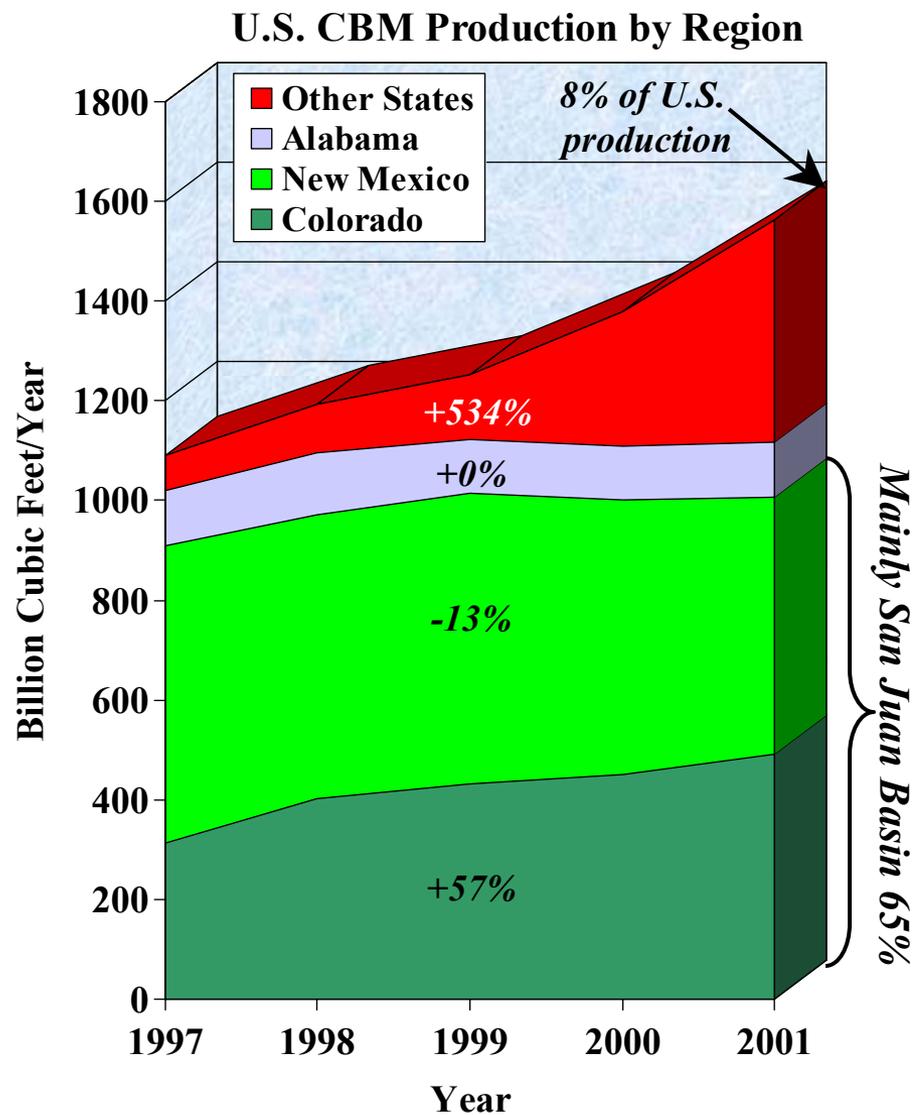
Supply Push Scenario



Techno-Vert Scenario

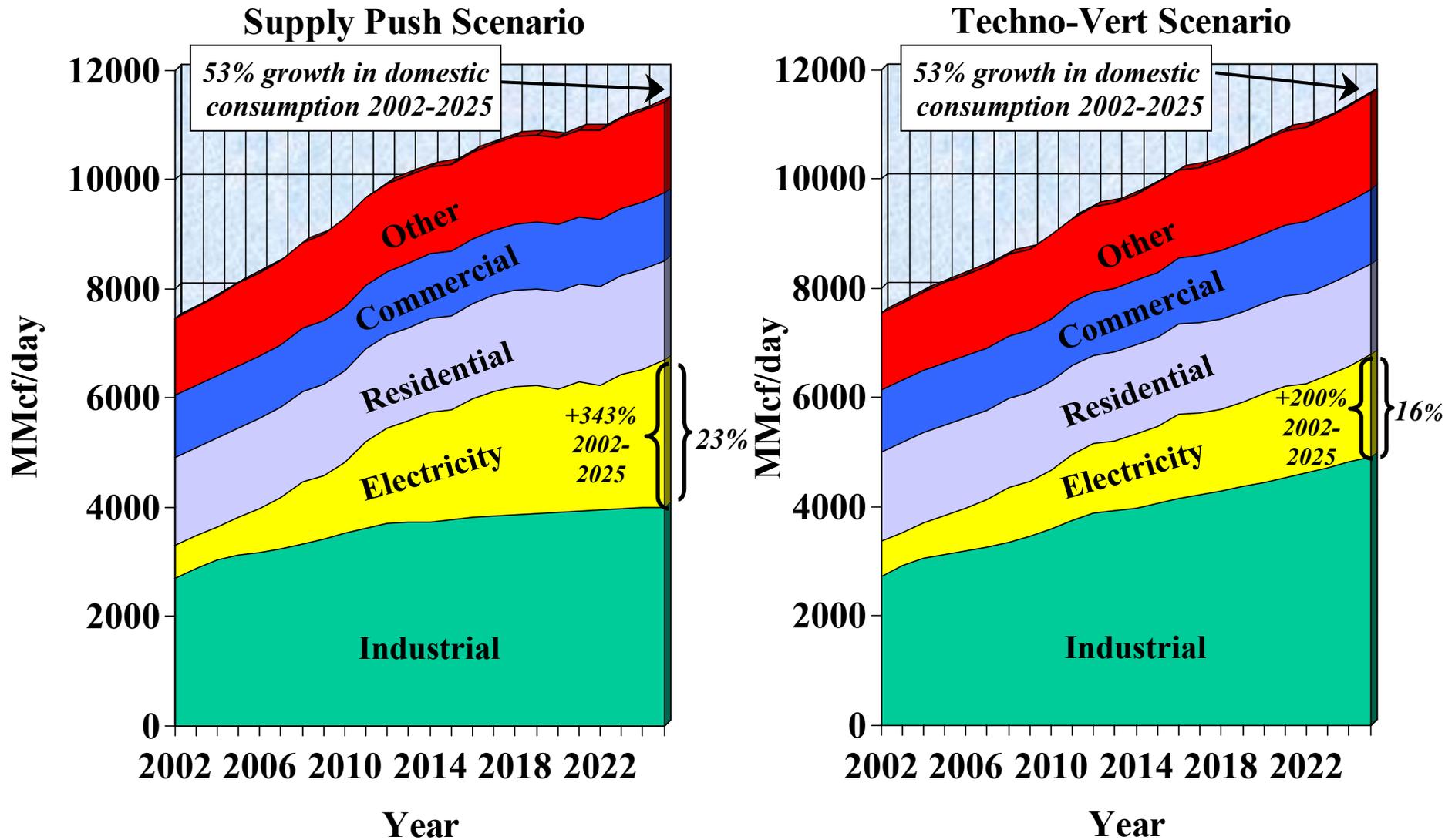


Actual Coalbed Methane Production in the U.S. 1997-2001 Compared to NEB Coalbed Methane Production Scenarios 2003-2025



(data from Energy Information Administration, 2004, and National Energy Board, July, 2003)

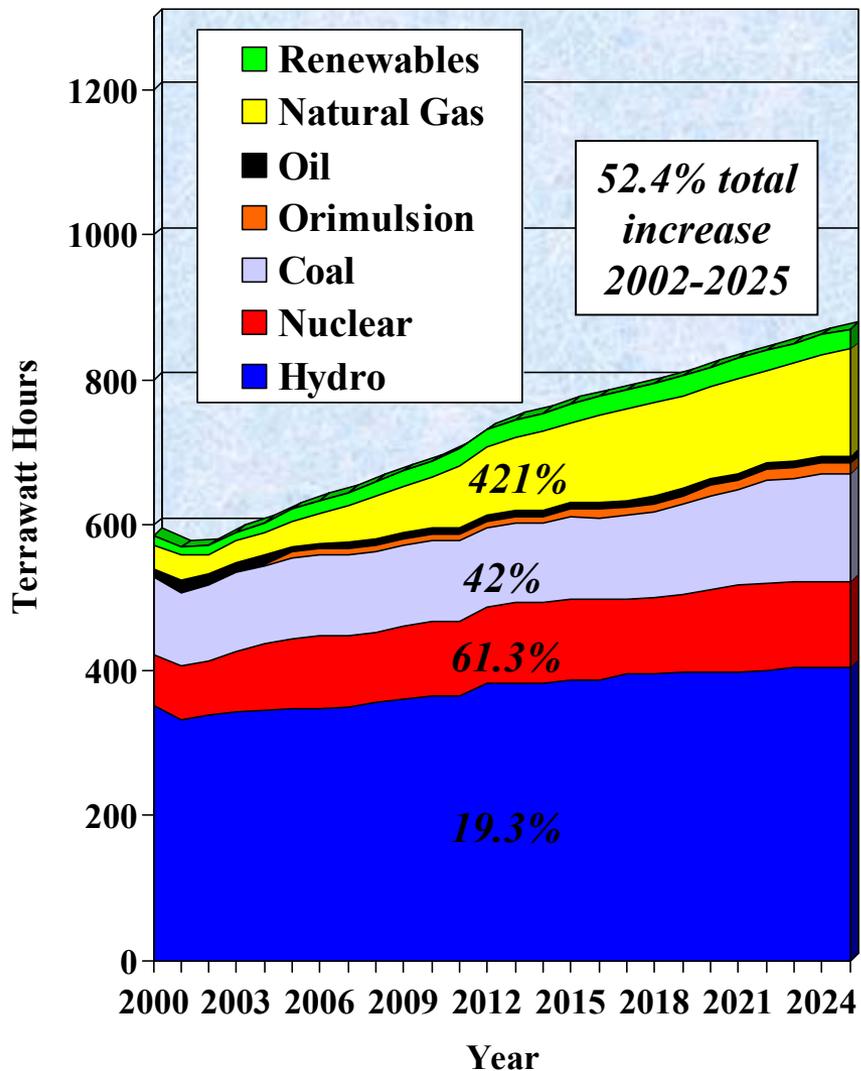
NEB, 2003, Canadian Domestic Natural Gas Demand Scenarios by Sector, 2002-2025



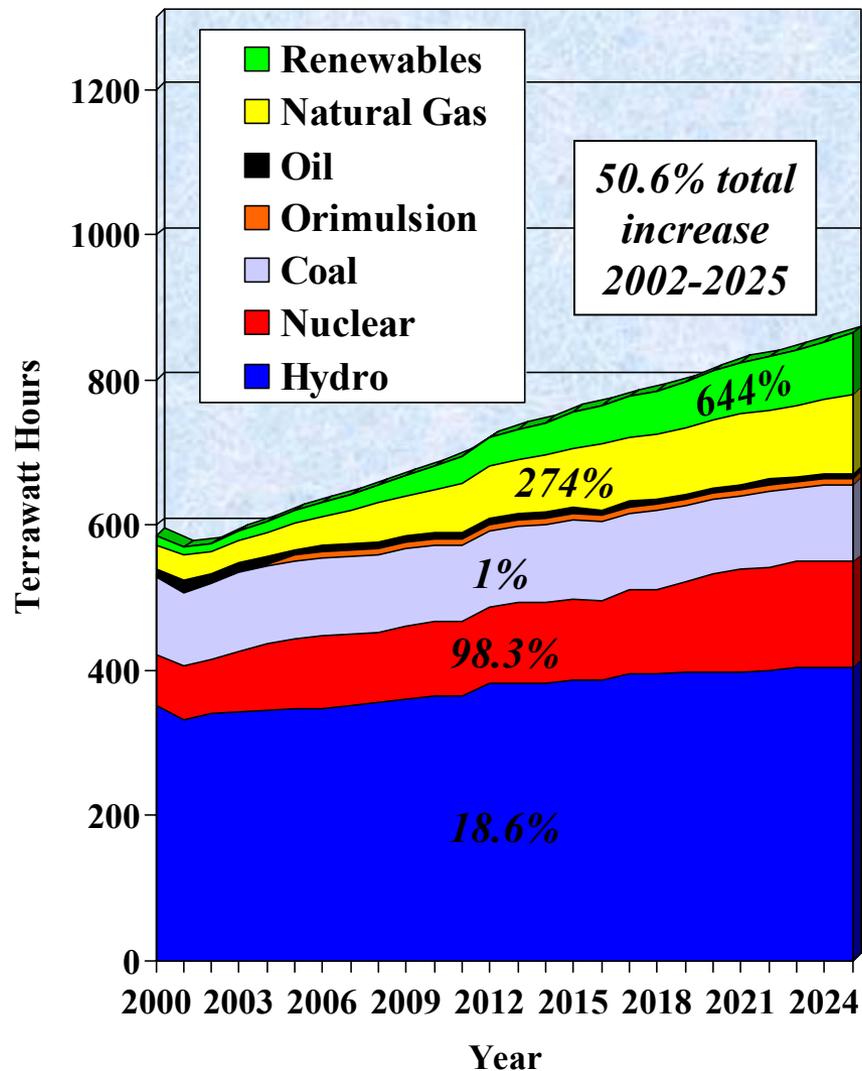
(data from National Energy Board, July, 2003)

Canadian Electricity Generation Scenarios by Fuel, 2000-2025

Supply Push Scenario

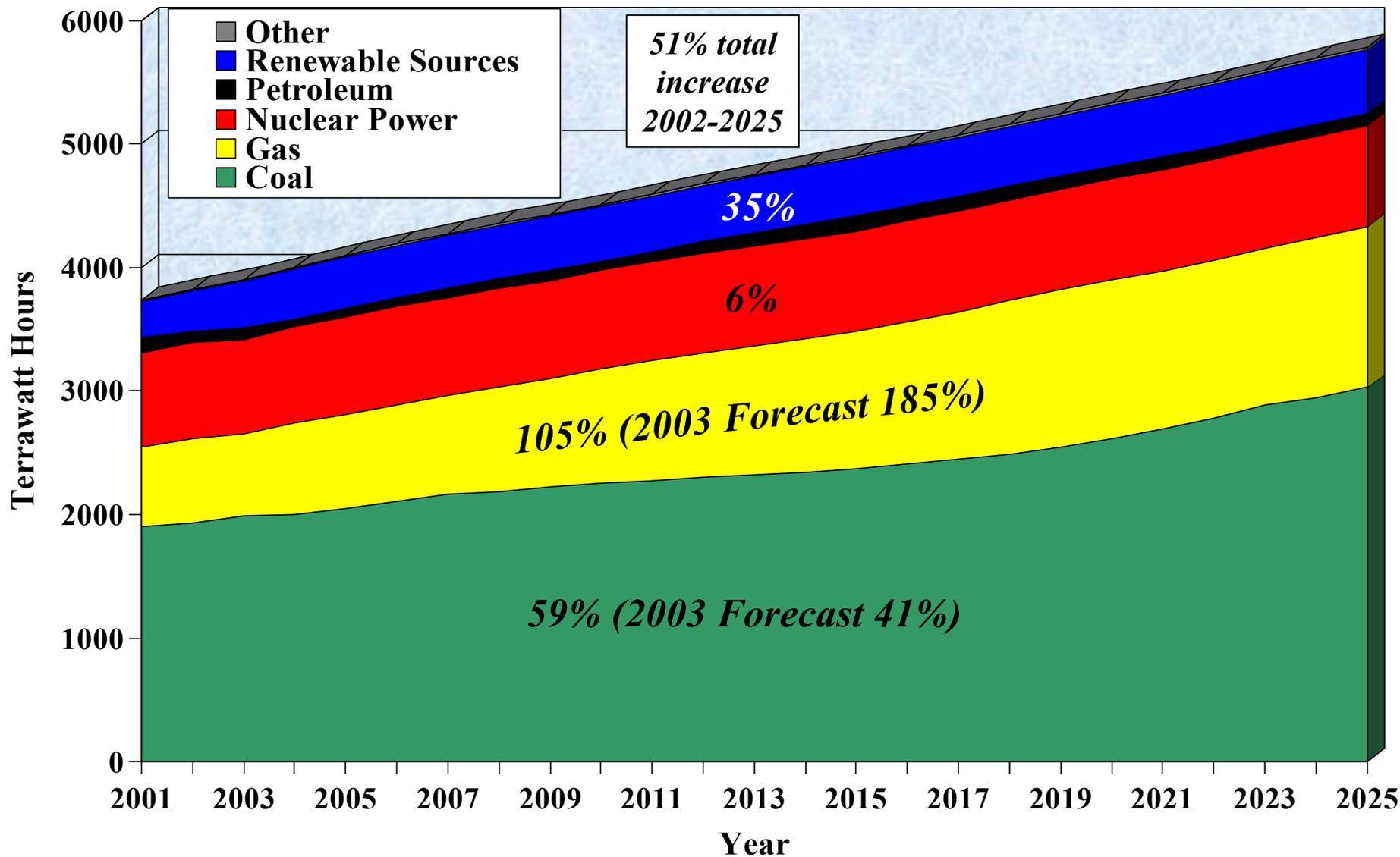


Techno-Vert Scenario

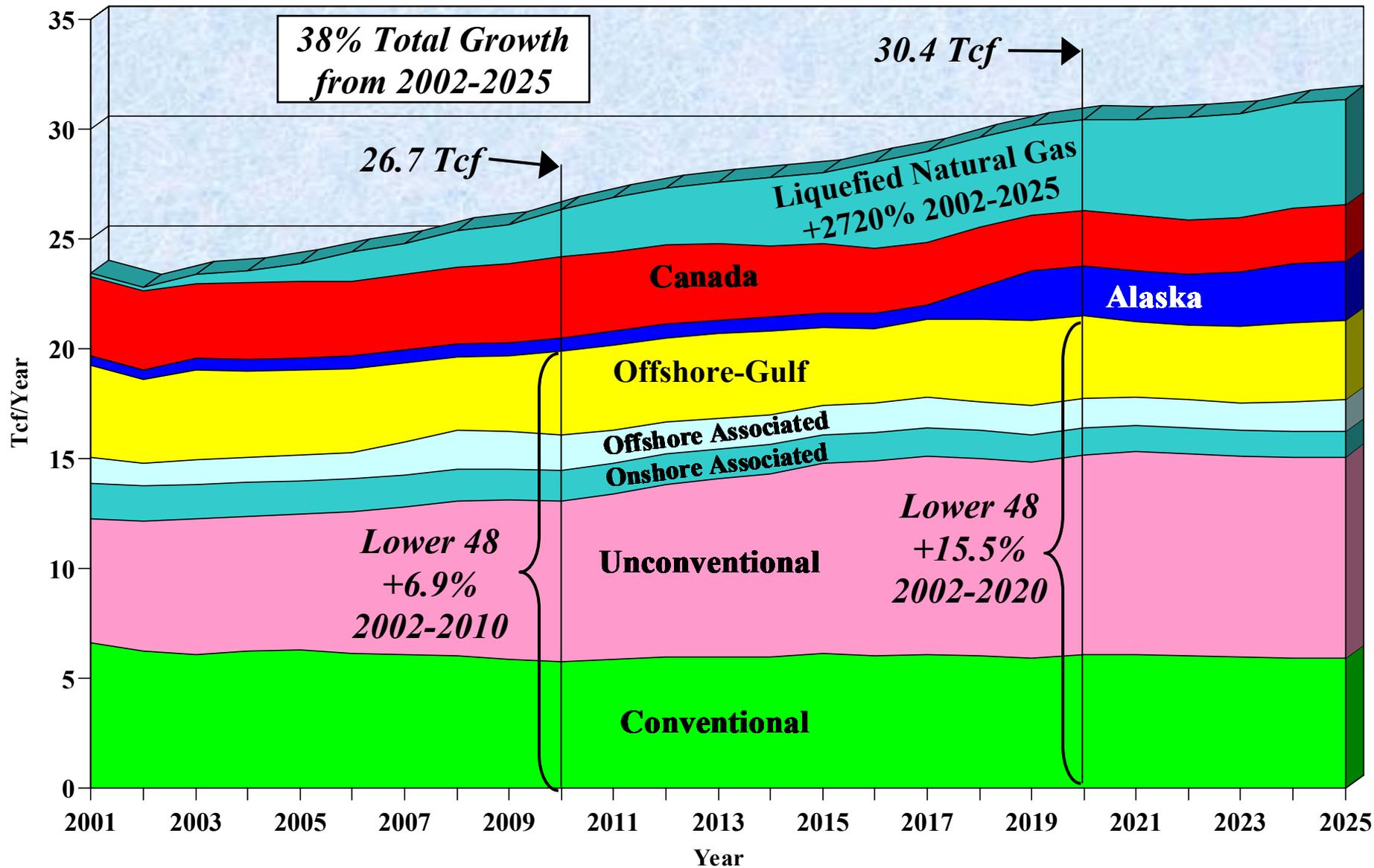


(data from National Energy Board, July, 2003)

Forecast U.S. Electricity Generation by Fuel Type 2001-2025 (EIA Annual Energy Outlook, 2004, Reference Economic Case)

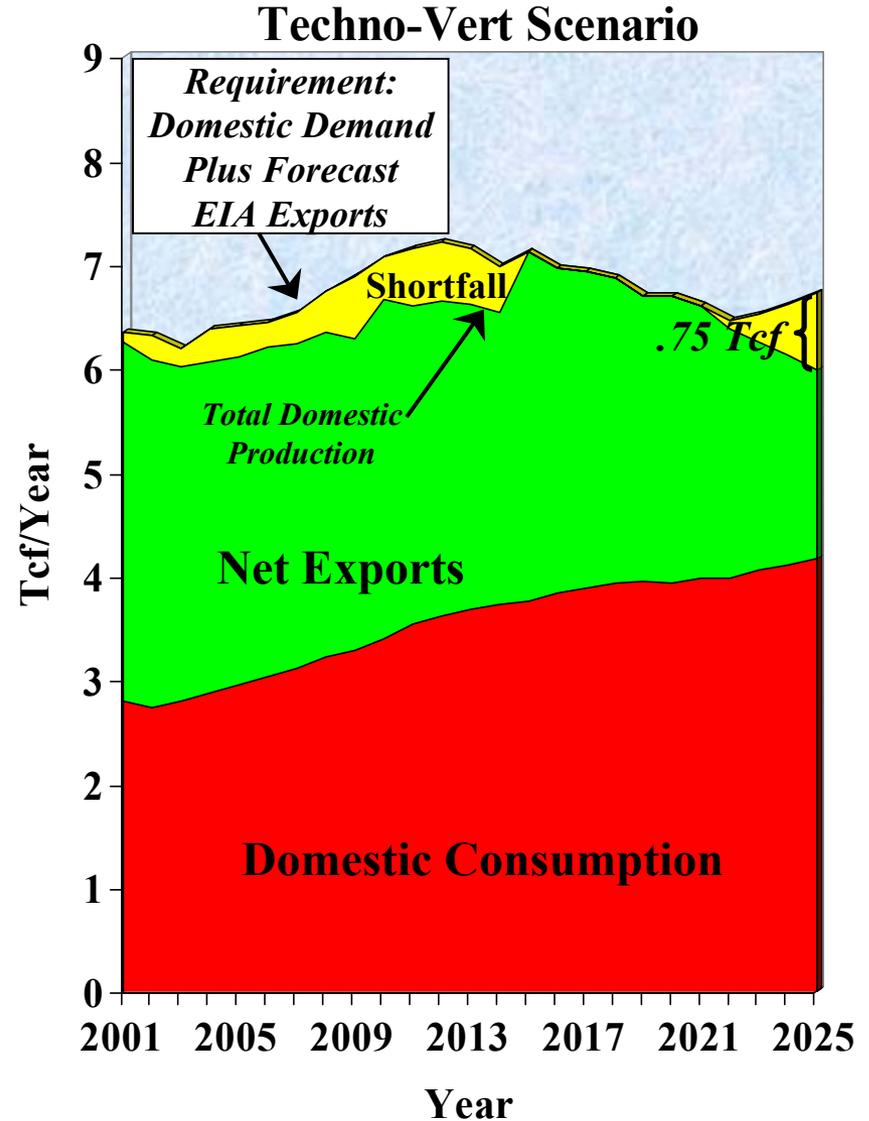
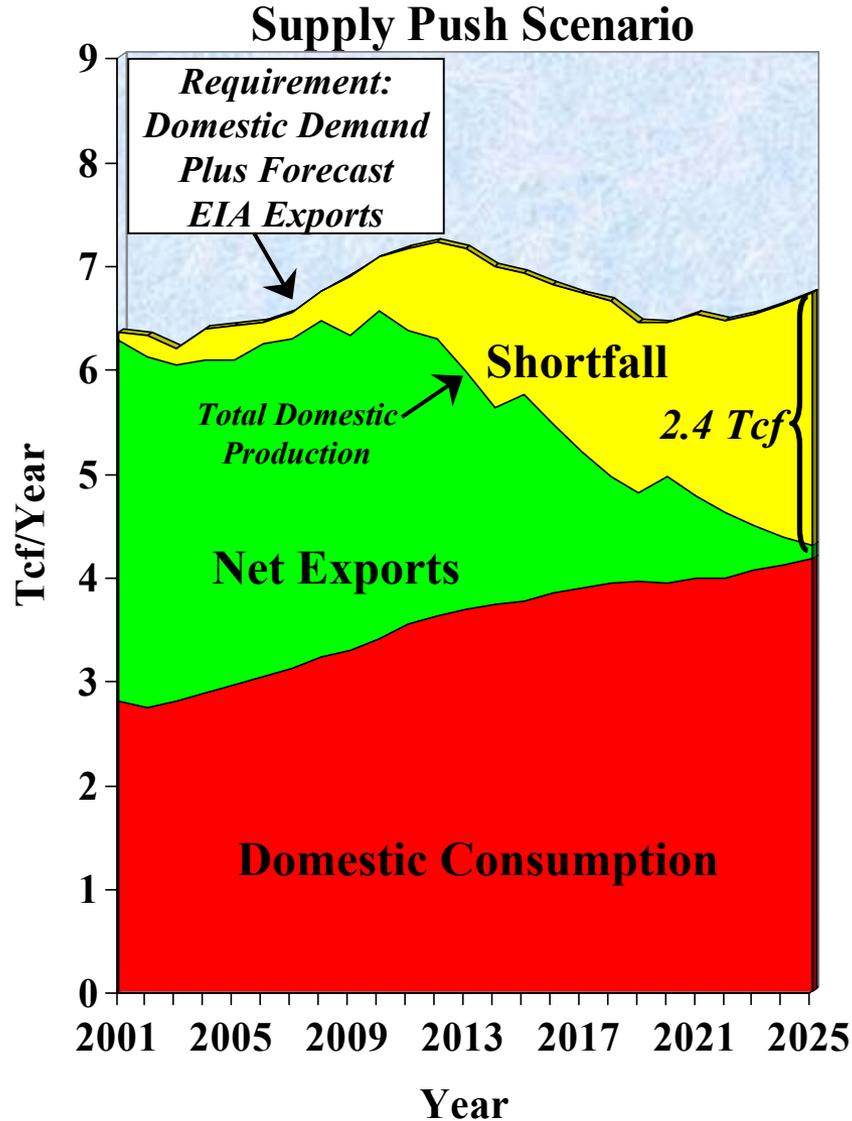


U.S. Natural Gas Supply by Source (EIA Annual Energy Outlook, 2004, Reference Economic Case)



(data from Energy Information Administration Annual Energy Outlook, 2004)

Canadian Shortfalls in Gas Supply Given Domestic Production Scenarios and Forecast EIA (AEO 2004) Reference U.S. Import Requirements

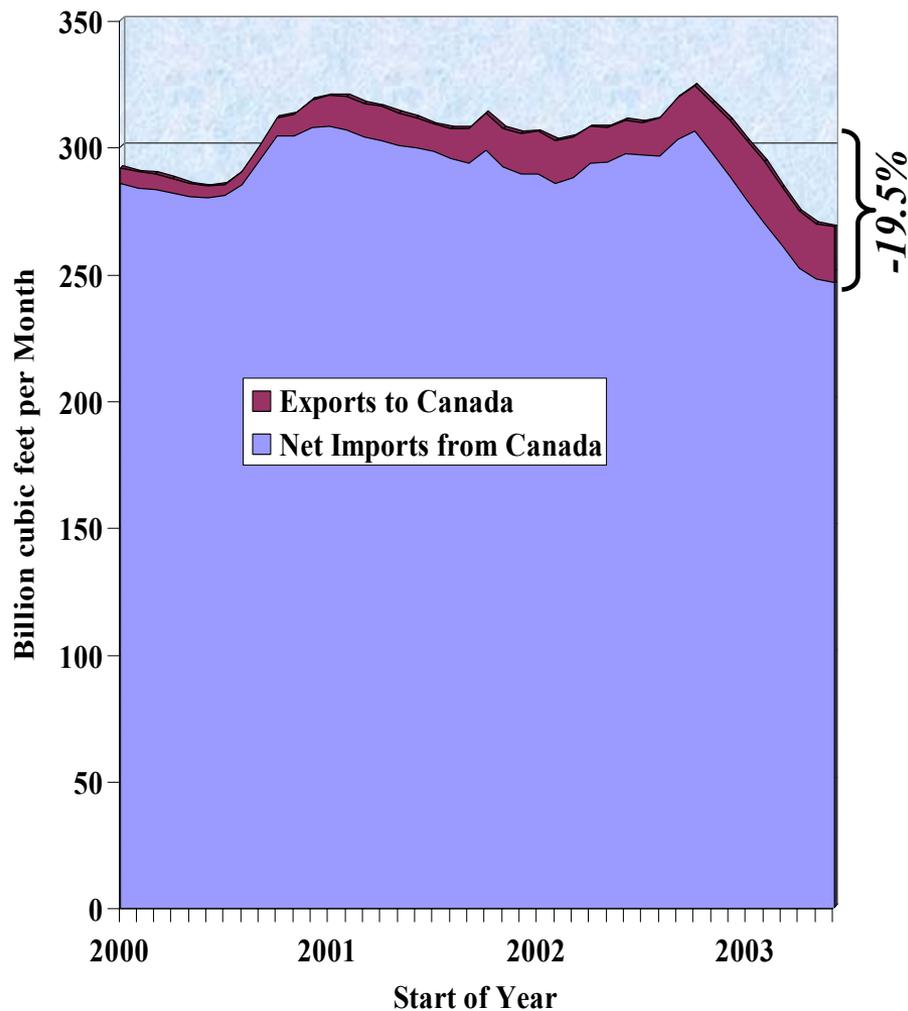


Note: Forecast Canadian LNG Imports are Excluded from Domestic Production

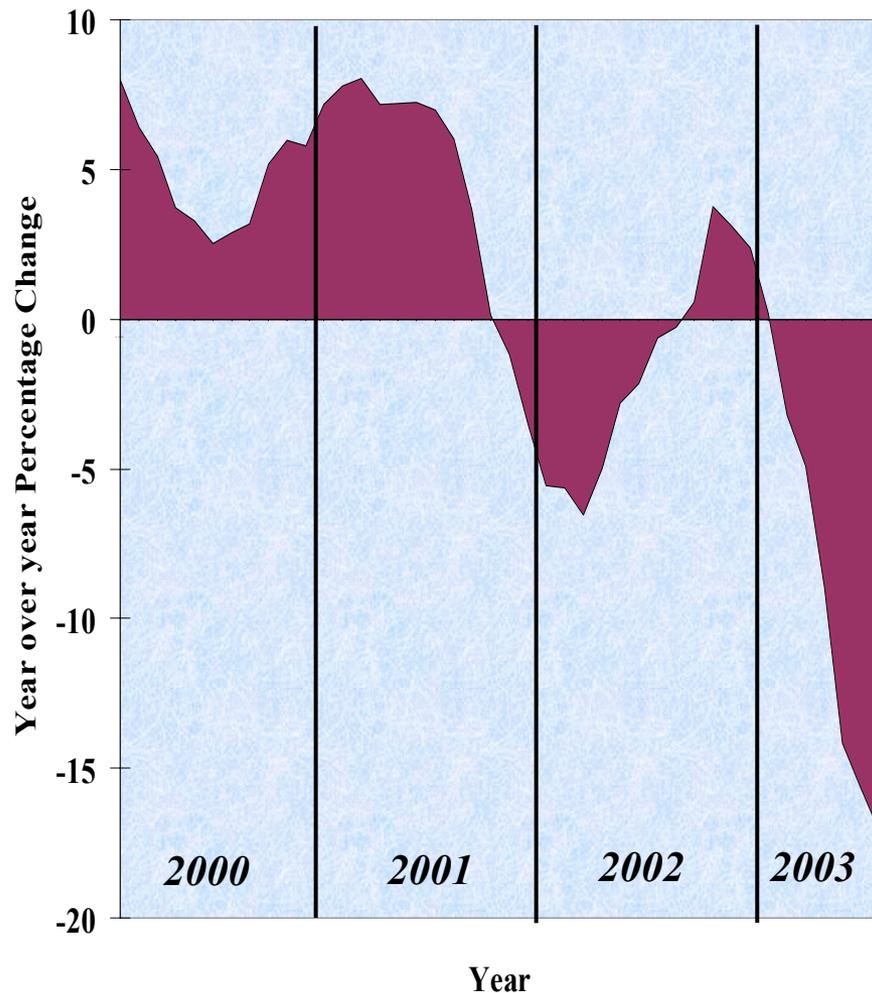
(data from National Energy Board, July, 2003, and EIA Annual Energy Outlook, 2004)

Natural Gas Trade Between Canada and the U.S. 2000-2003

Gas Movements (7 month moving average)

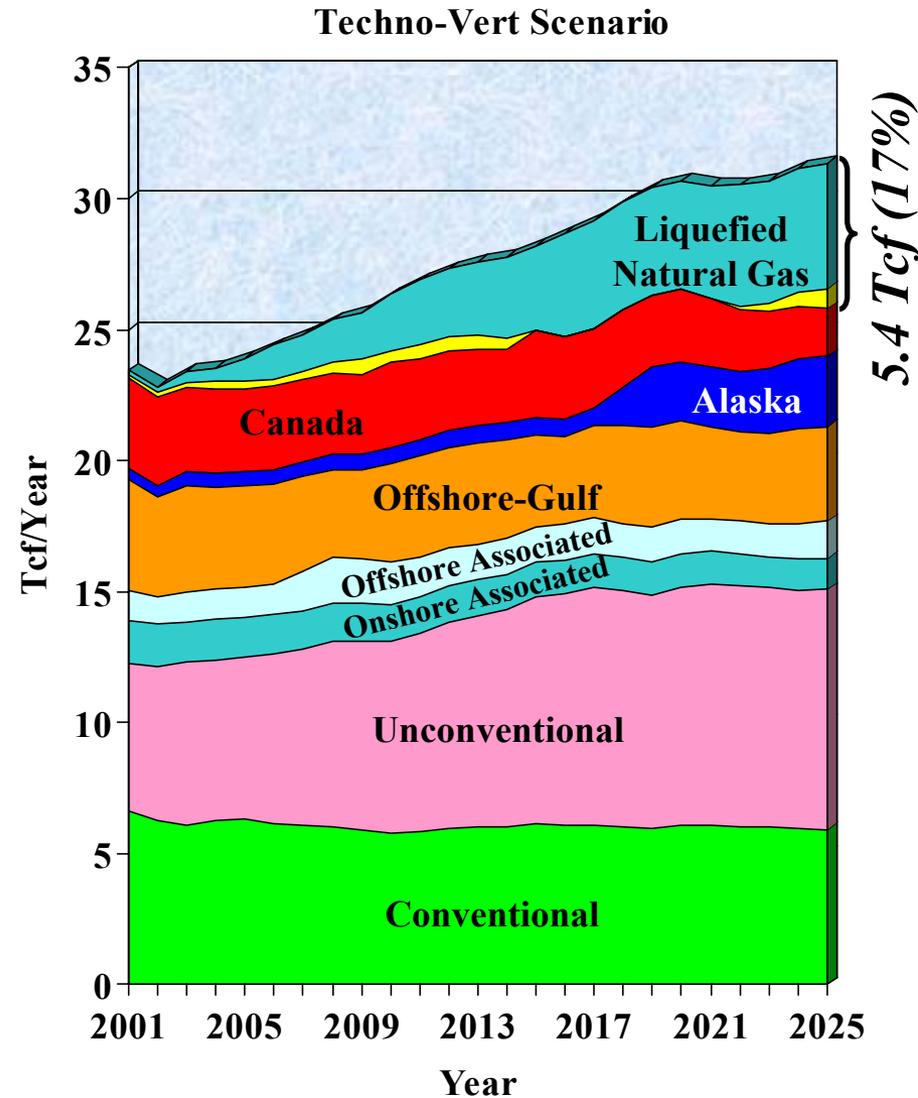
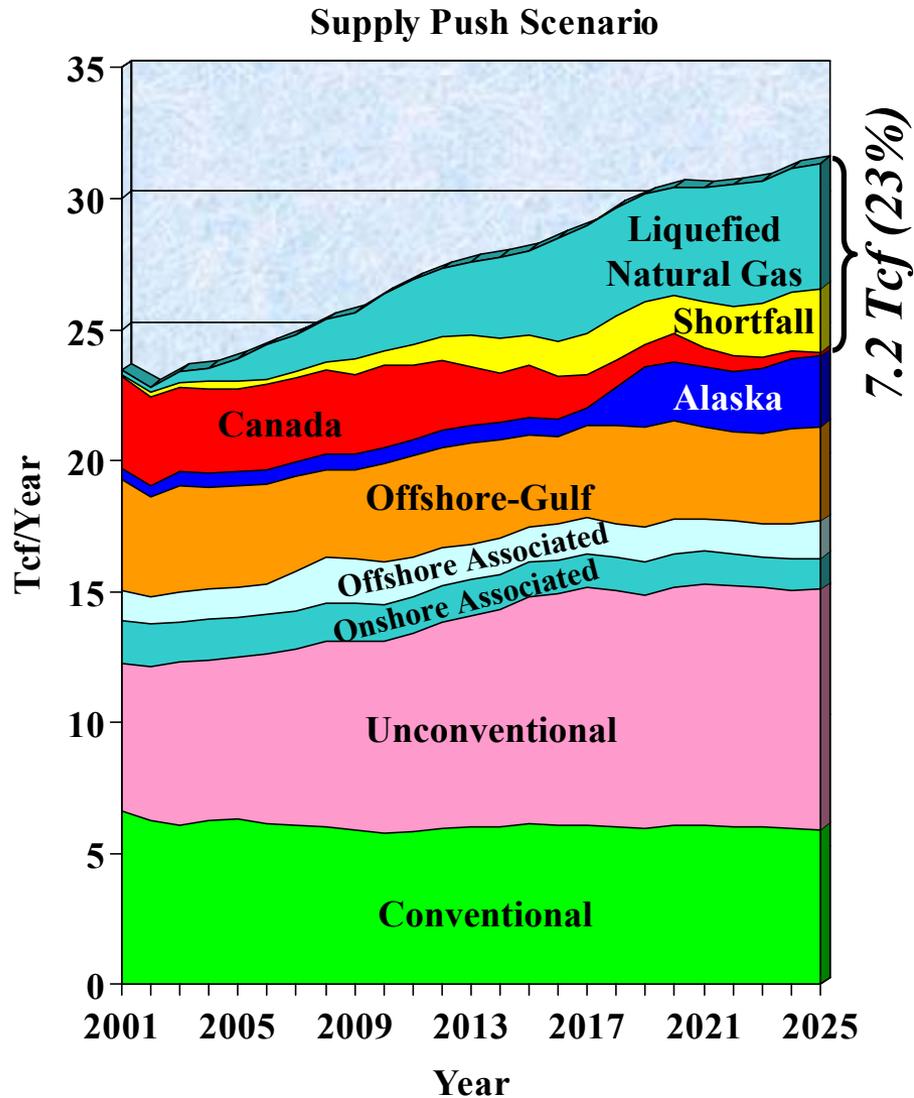


Canada Imports Year-over-Year Percentage Change (7 month moving average)



(data from Energy Information Administration, 2004)

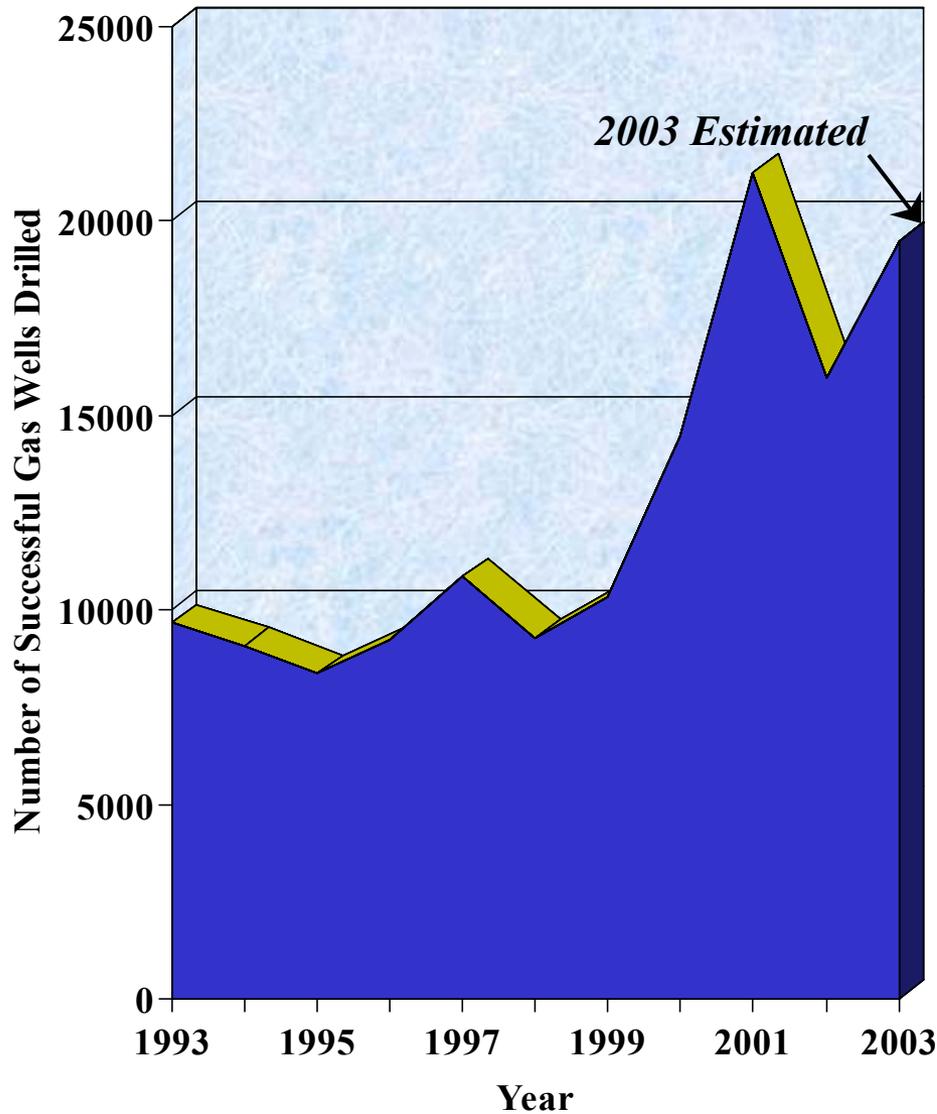
U.S. Supply with Canadian Imports and Shortfalls Given NEB, 2003, Supply Scenarios, EIA Production Growth Scenarios and EIA Reference Case Import Requirements



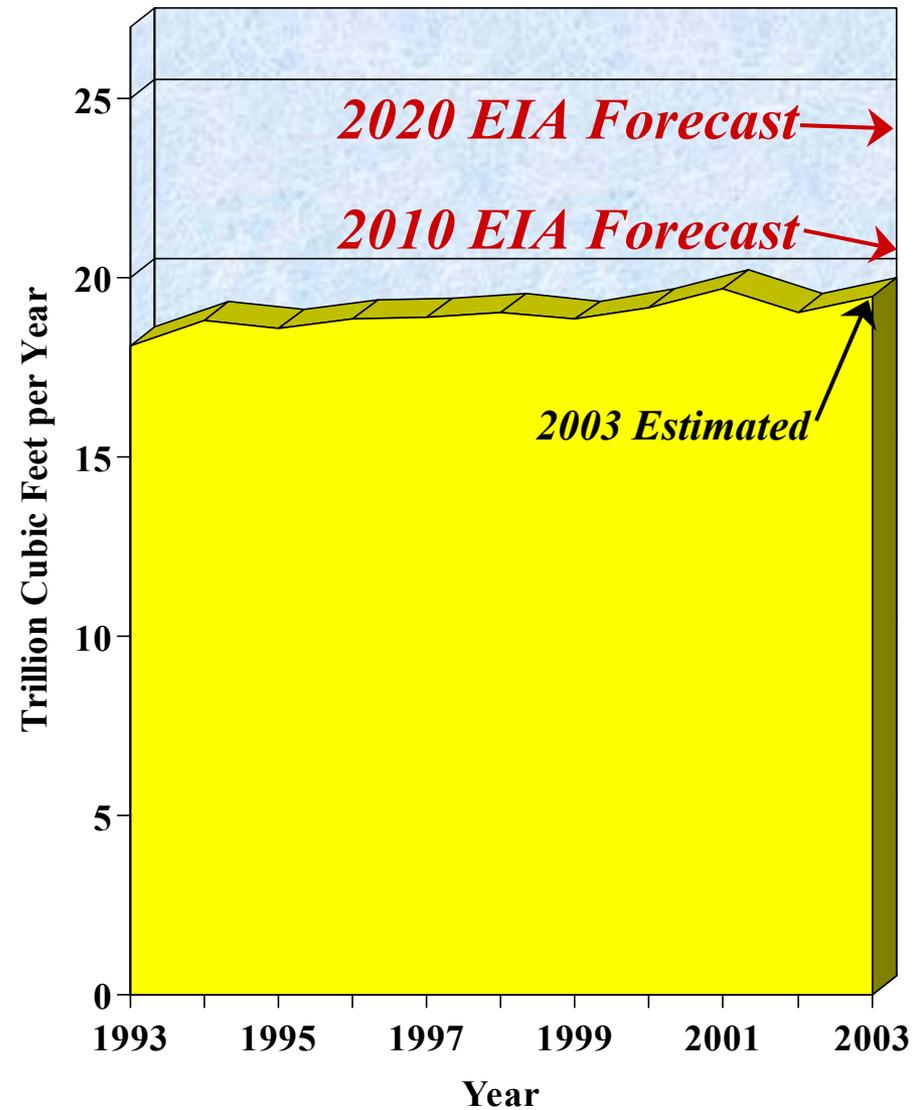
(data from Energy Information Administration Annual Energy Outlook, 2004, and National Energy Board, July, 2003)

The U.S. Gas Exploration Treadmill

U.S. Gas Wells Drilled 1993-2003



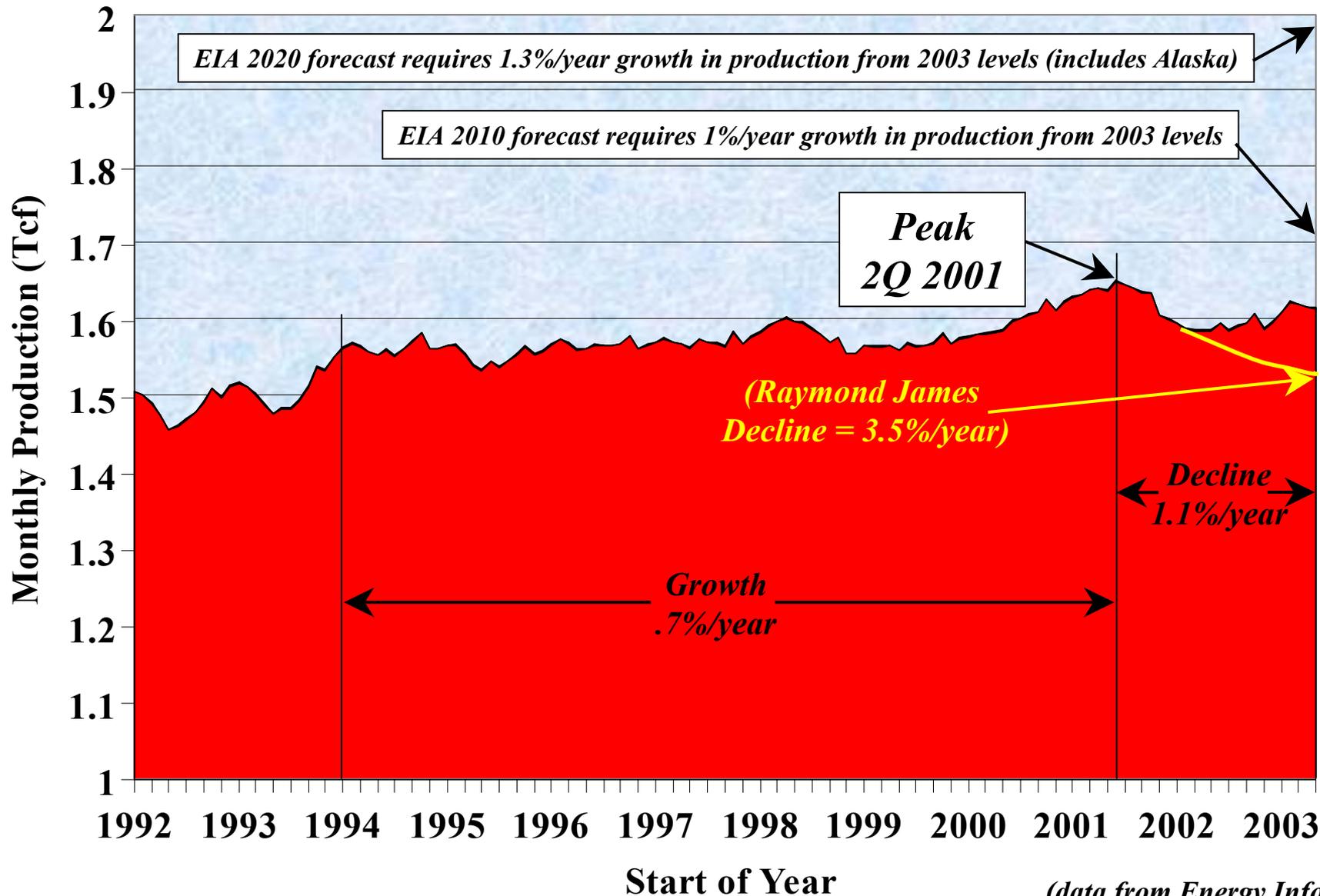
U.S. Dry Gas Production 1993-2003



(data from Independent Petroleum Association of America, 2004, and U.S. Energy Information Administration, 2004; 2003 estimates based on first 8 months of 2003 compared to same period in 2002)

U.S. Dry Gas Production 1992-2003

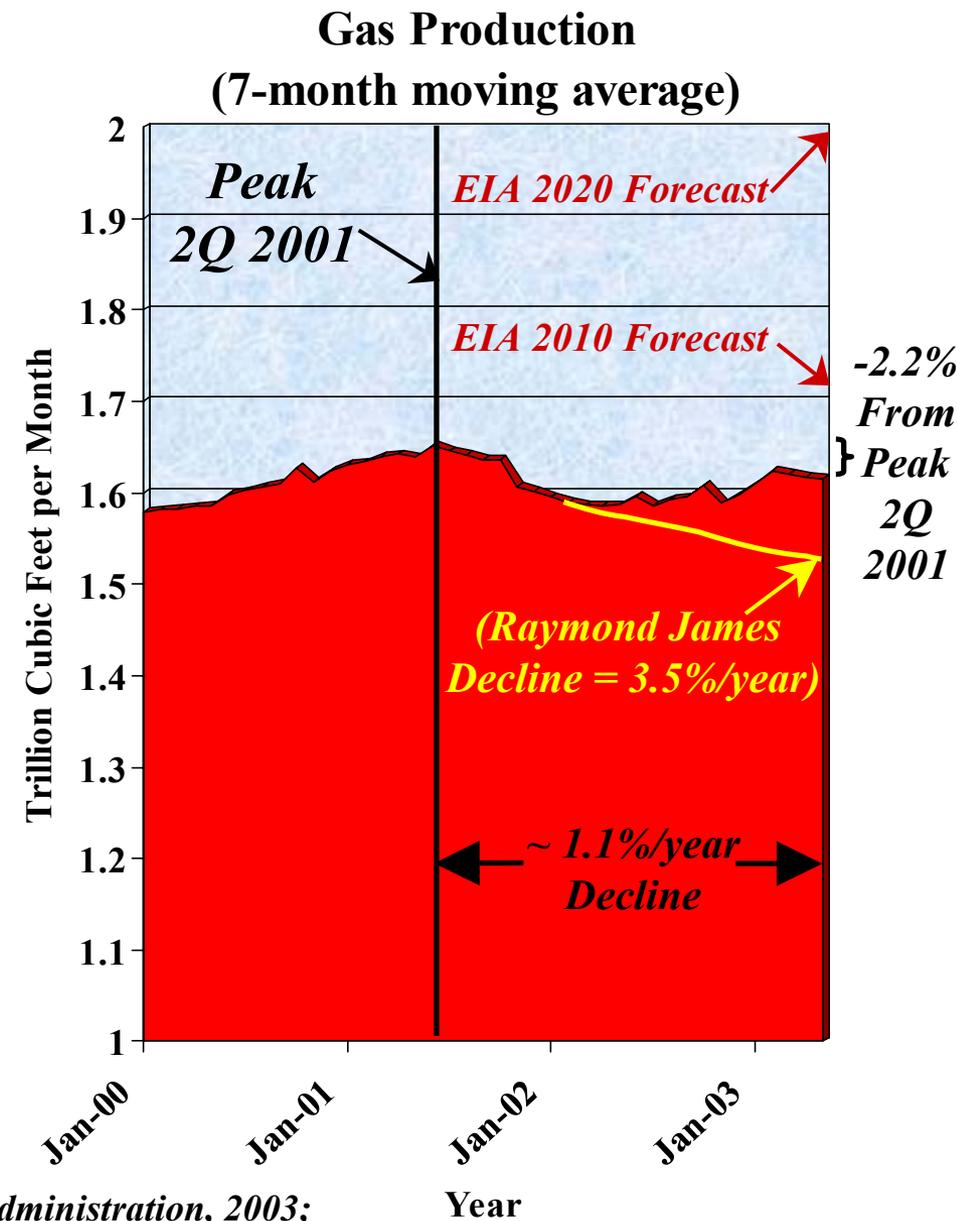
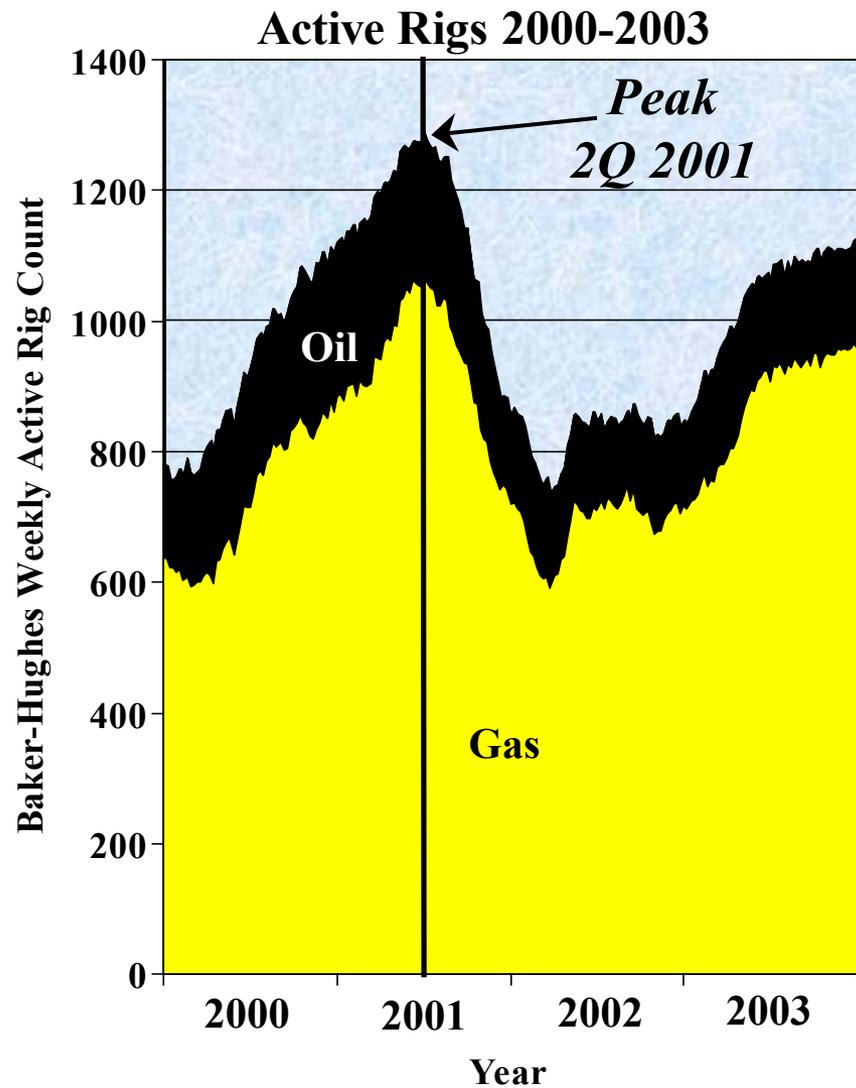
7 month moving average



(data from Energy Information Administration, 2003; Raymond James and Associates Inc. decline rates based on independent survey of producers)

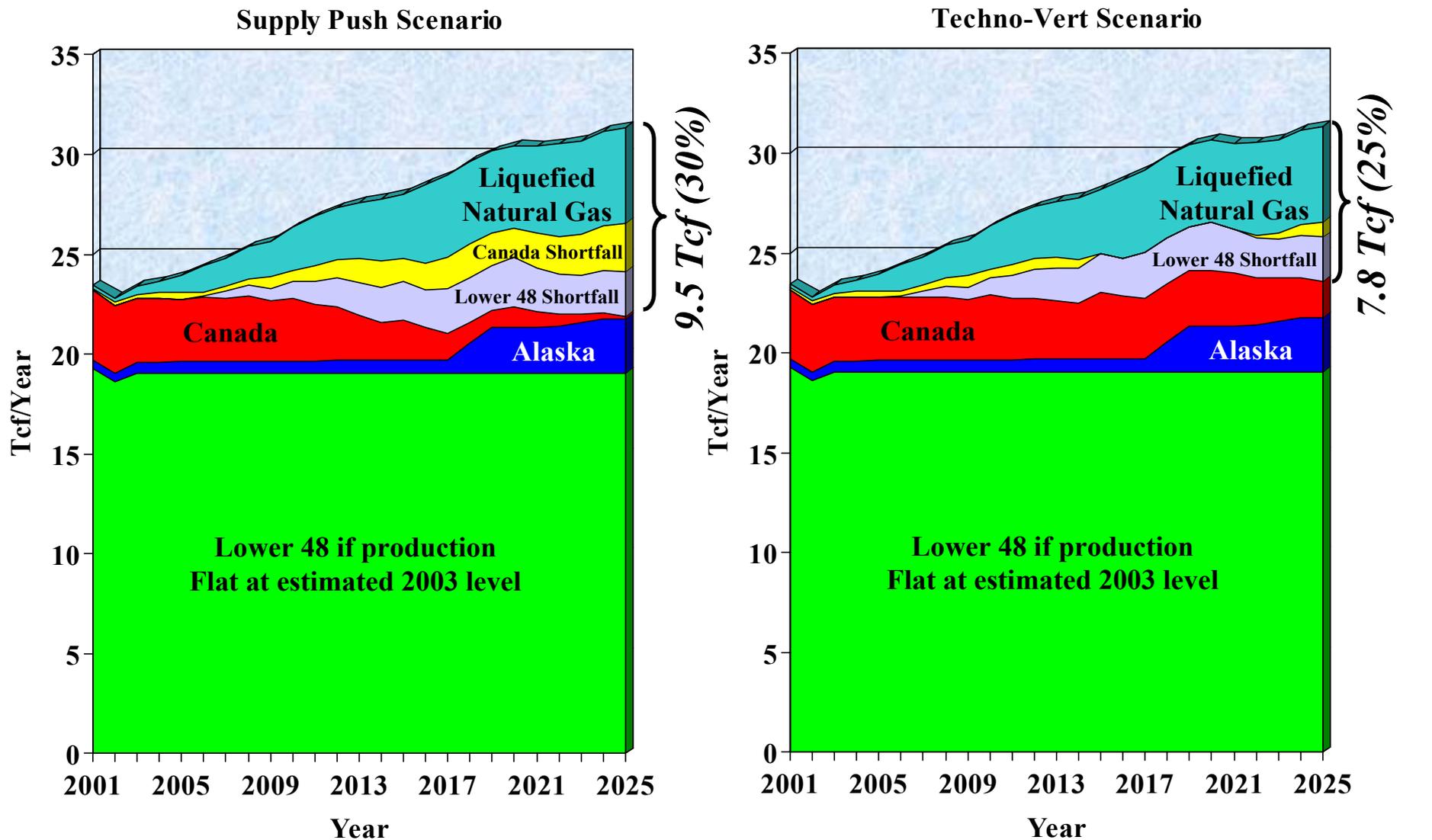
U.S. Active Drilling Rig Count and Dry Gas Production 2000-2003

(2003 U.S.A. Decline Rate is now 28%)



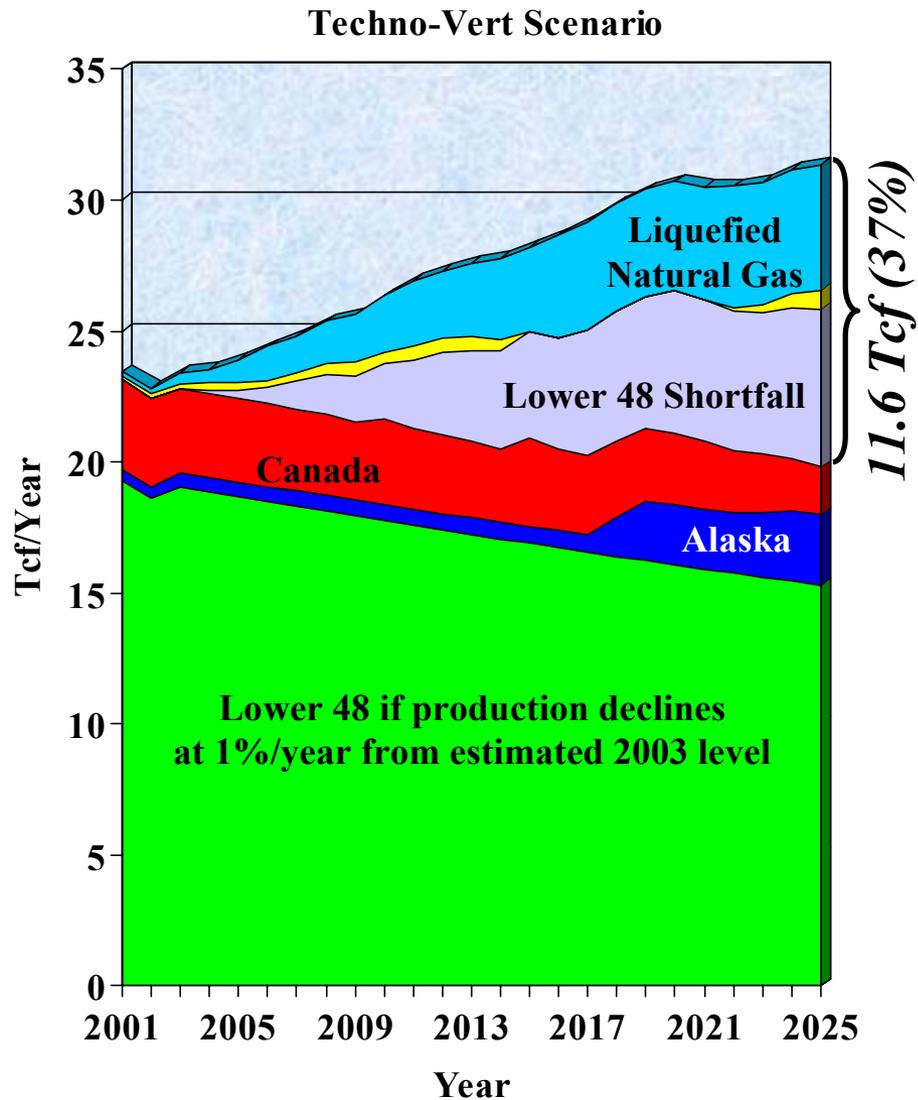
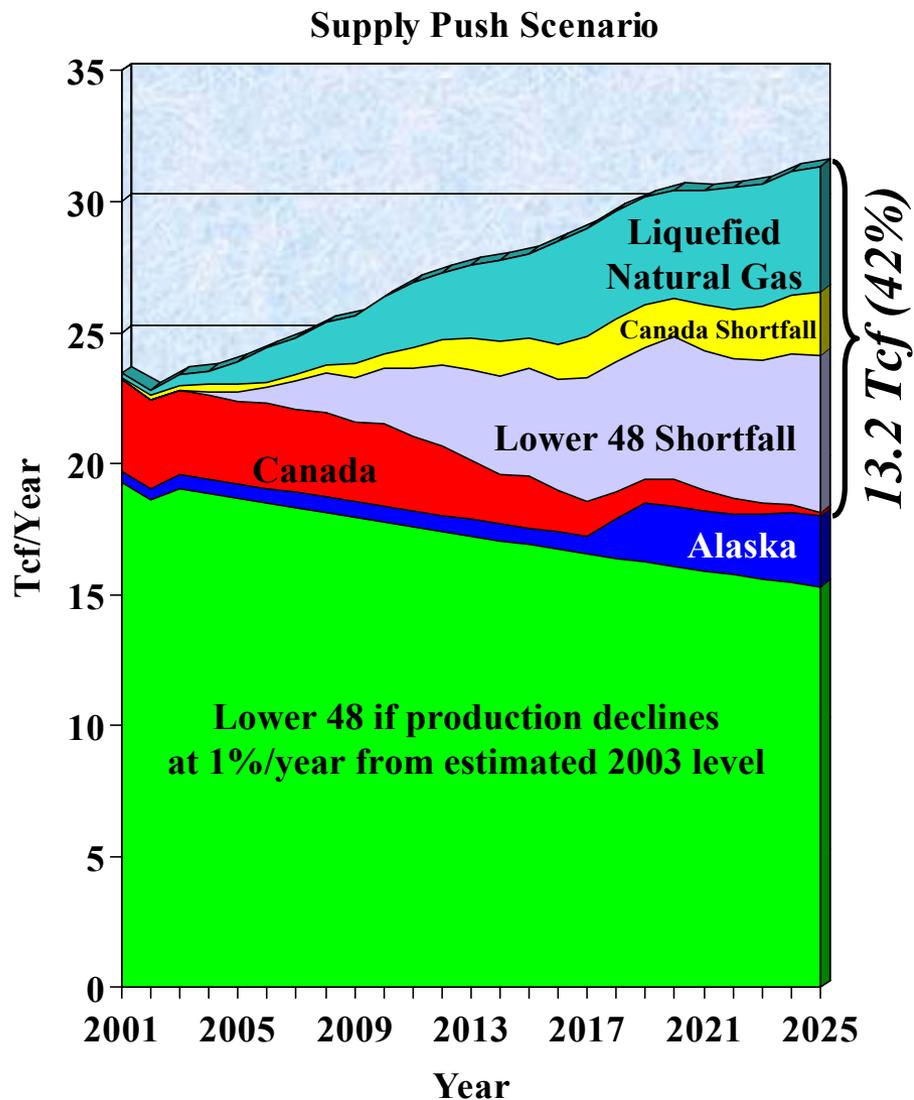
(data from Baker-Hughes, 2004, and Energy Information Administration, 2003; Raymond James and Associates Inc. decline rates based on independent survey of producers)

U.S. Supply with Canadian Imports and Shortfalls Assuming NEB, 2003, Canadian Supply Scenarios, Flat Lower 48 Production and EIA Reference Case Import Requirements



(data from Energy Information Administration Annual Energy Outlook, 2004, and National Energy Board, July, 2003)

U.S. Supply with Canadian Imports and Shortfalls Assuming NEB, 2003, Canadian Supply Scenarios, a 1% Decline in Lower 48 Production and EIA Reference Case Import Requirements



(data from Energy Information Administration Annual Energy Outlook, 2004, and National Energy Board, July, 2003)

FUTURE OUTLOOK:

- ***IMPLICATIONS*** – If supply and demand forecasts are to be believed, there appear to be serious supply shortfalls in Continental natural gas coming – *Canada is unlikely to be able to fill the supply gap*

- ***SOLUTIONS*** - probably involve a portfolio of options:

- Conservation and Efficiency

- LNG – *already factored into existing forecasts;*

GEOPOLITICAL + NIMBY IMPLICATIONS

- Unconventional Gas - *already factored into existing forecasts in a big way*

- Fuel Switching – *to oil or coal – capacity quite limited without new capital investment*

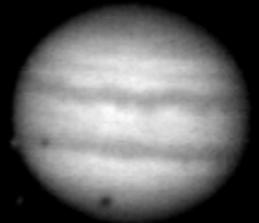
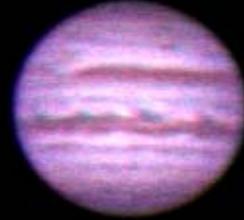
- Destroy Demand – *move gas intensive industries offshore (fertilizer and petrochemical plants) - this is already happening; GEOPOLITICAL IMPLICATIONS*

The Continental Demand/Production Gap

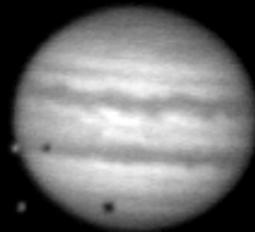


*If all the Planets Line UP:
5.4 Tcf/Year (17%) by 2025*

The Continental Demand/Production Gap



*If the Planets Don't Line UP:
13.2+ Tcf/Year (42+%) by 2025*



Conclusions

THERE ARE CHALLENGES AHEAD IN MEETING DEMAND EXPECTATIONS FOR NORTH AMERICAN NATURAL GAS:

- Several existing producing areas in North America are in or near decline.***
- Canada may not be able to meet its own forecast needs and U.S. forecast expectations for exports after 2004, depending on the pace of new conventional development, the success of the development of non-conventional gas, and the development of LNG import capacity in Eastern Canada.***
- Higher cost frontier and offshore conventional production and non-conventional production from coalbed methane, tight gas and shale gas likely cannot forestall the declines in production for long unless as-yet-unproven windfalls result from hydrates and other non-conventional sources***
- Solutions include conservation and efficiency, LNG imports, demand destruction, additional non-conventional gas and fuel switching***



Thank you

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