

New Opportunities in a Mature Basin: Gas Discoveries in the Western Canadian Sedimentary Basin

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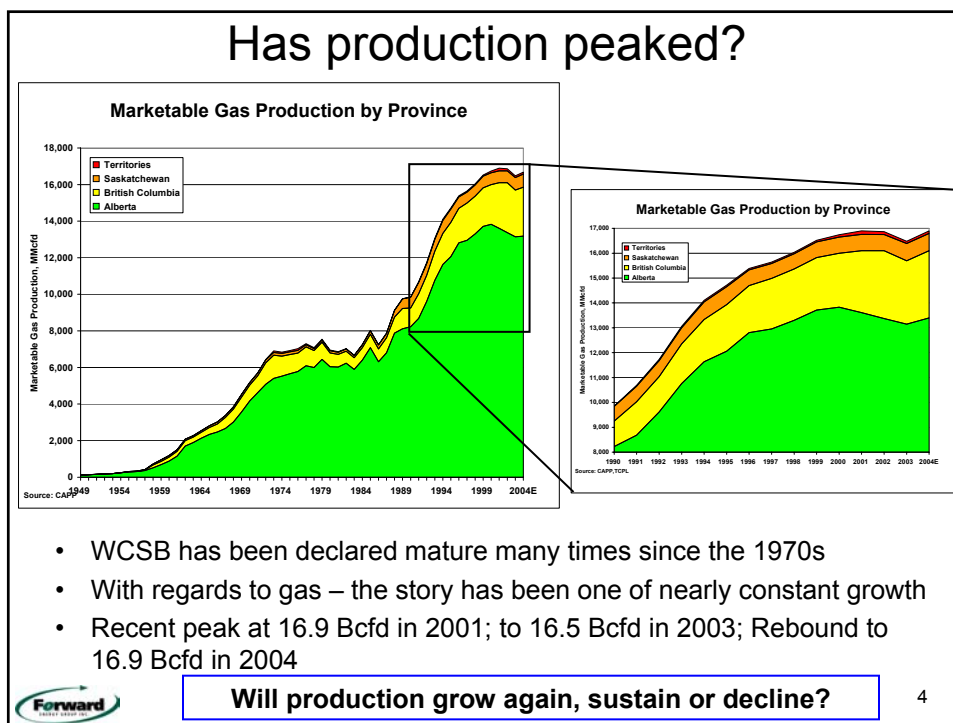
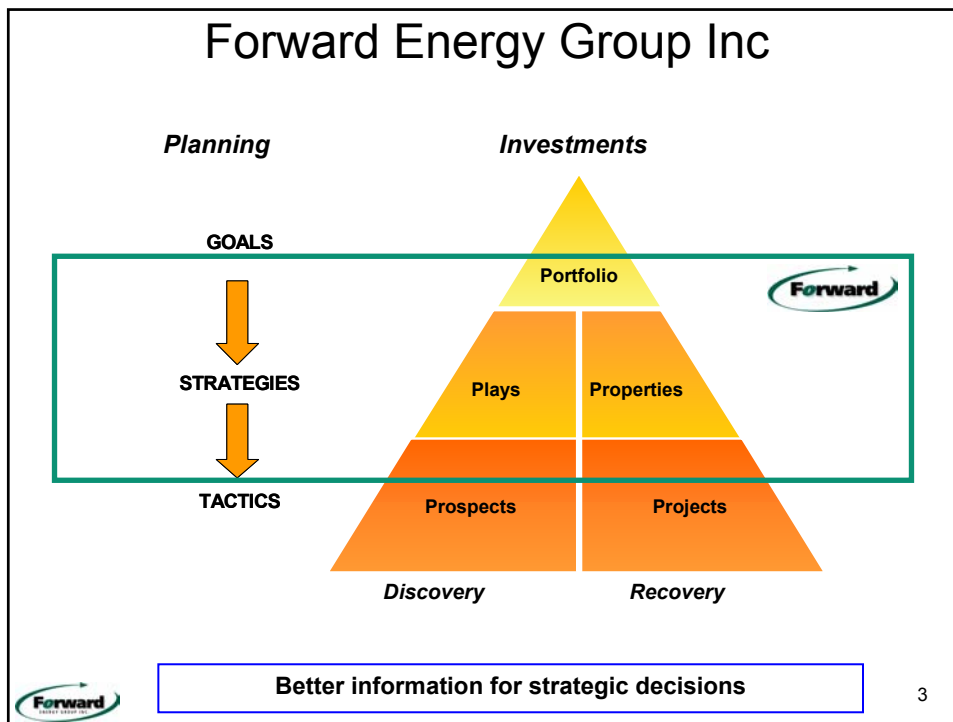
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State of the Basin

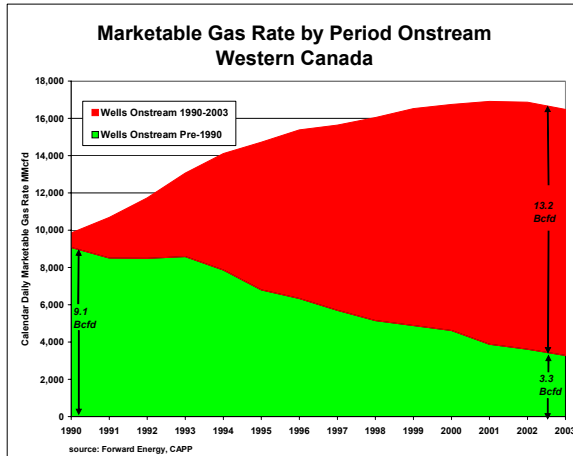
- Introduction
- Supply treadmill
- Basin is maturing, but its death has been exaggerated
- The challenge to sustain supply profitably - - how has industry been meeting this challenge?
- Increasing effort for less rate and reserves
- New supply: New pool discoveries and new areas
- Technologies: fracturing and directional wells
- Future supply scenarios



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Supply Challenge : Sustain Production



- Total production flat at 16.7 Bcfd \pm 0.2
- Decline in production from connected wells
- Rate additions from new wells onstream provide growth
- Wells onstream since 1989 produce 80% of gas

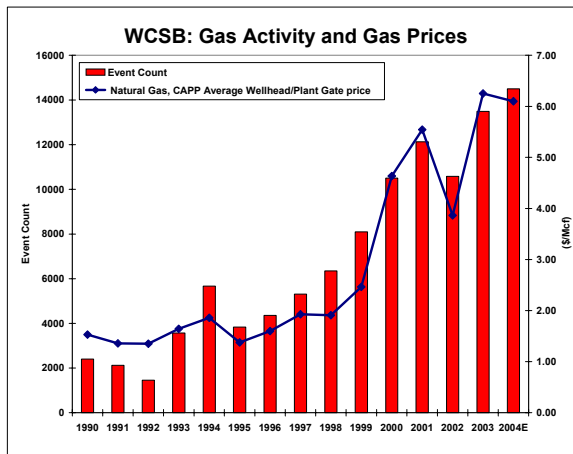
- WCSB supplies 23% of consumption in US and Canada



Competing processes of decline and rate additions

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How has industry responded?



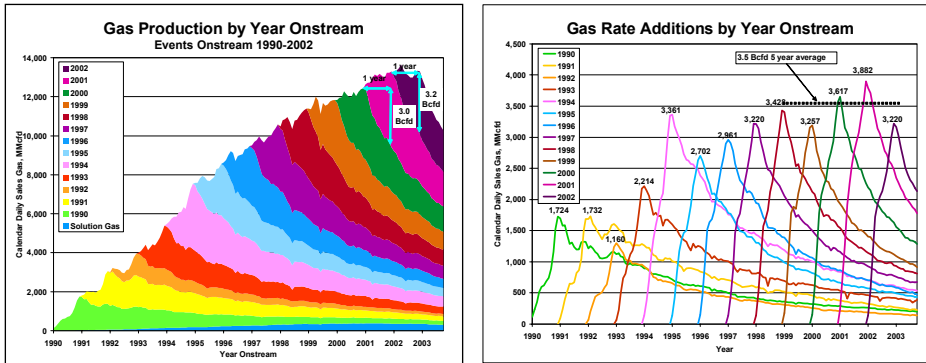
- Connection activity reached record levels, above 14,000 connections per year, by the end of 2004
- Activity, and rate additions, responded to prices, cash flow, acquisition and capital markets, export capacity, etc.



3.5 Bcfd average rate additions 1998 to 2002

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How big is the annual challenge?



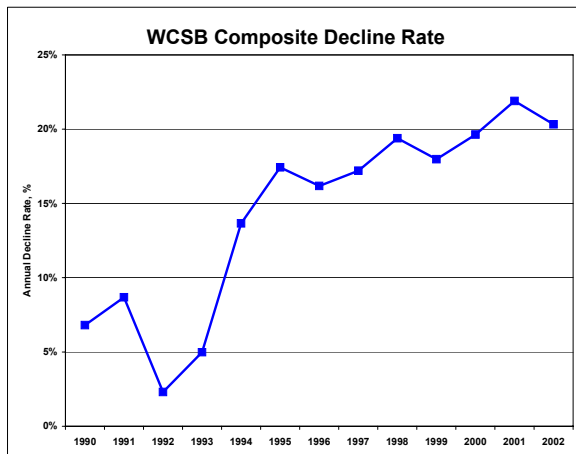
- Supply additions were 1.7 Bcfd in 1990, peaking at 3.9 Bcfd in 2001
- Shallow declines in early years; first year decline has increased from less than 30% to 40%
- Rate additions for all wells onstream in year is the peak monthly rate



Higher production rates require higher production replacement

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Composite Decline Rate

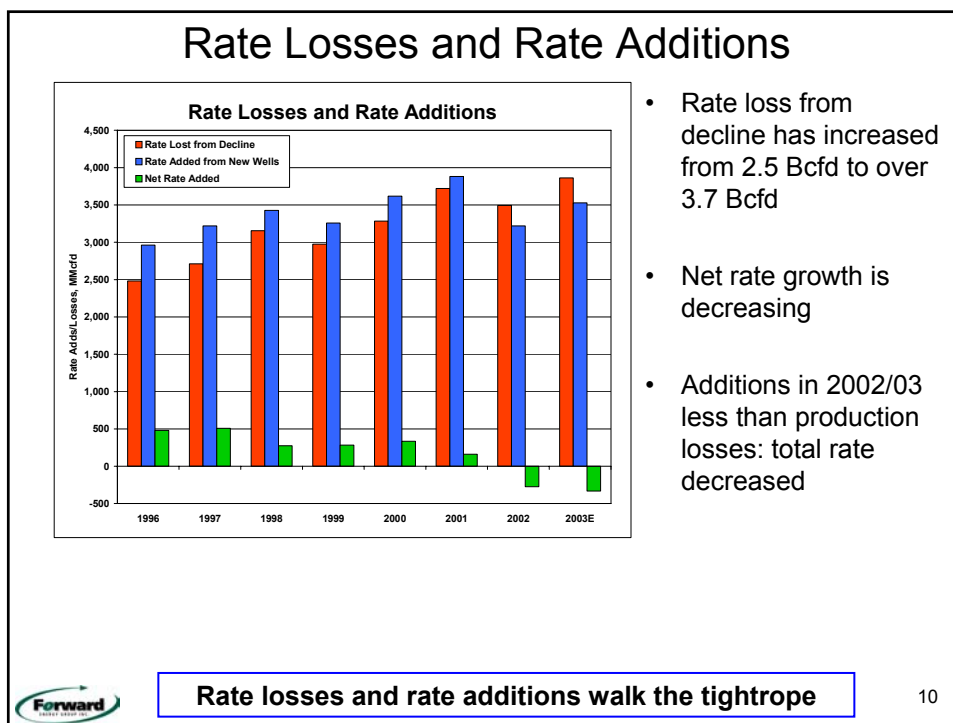
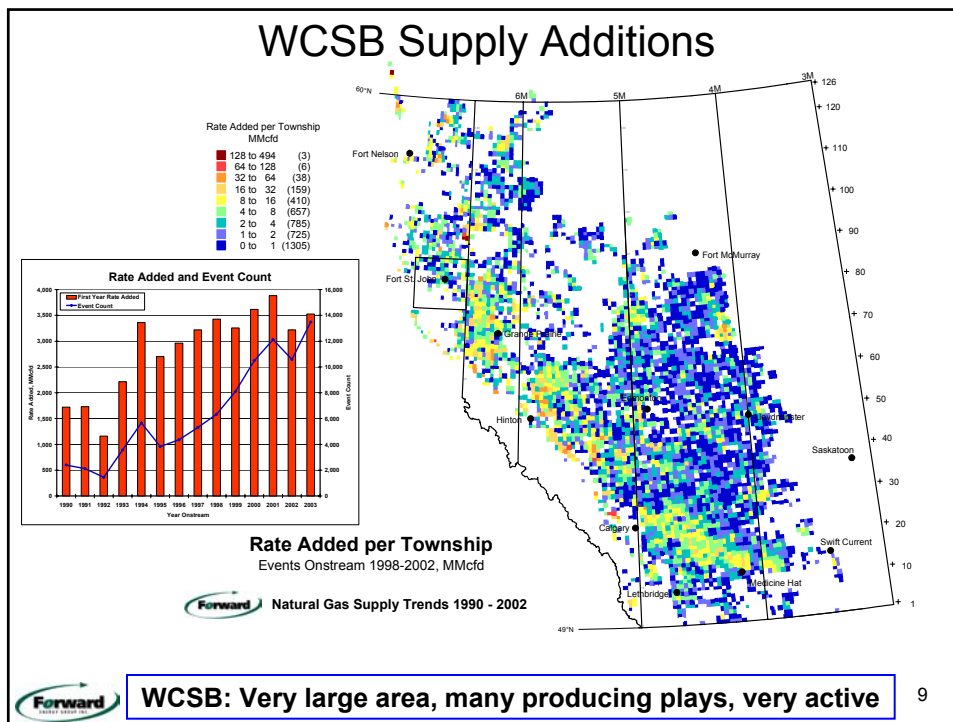


- Decline rate of **all** wells onstream is increasing
 - The production gap grows larger each year because composite decline rate is increasing
 - Composite decline rate may stabilize
- Pre-1994 composite decline was artificially low: reserves-based contracts, absence of pipeline capacity and storage, recession

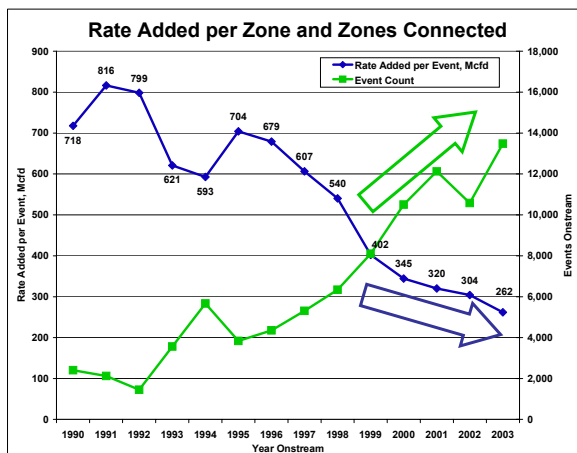


Increasing decline rate has increased the supply gap

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Is the sky falling?



- Over 90,000 events connected 1990-2003
- Rate added by new events declined to less than 300 Mcfd
- Threshold size of an economic well decreased as gas price and netback increased

- Expanded opportunity set: smaller, higher cost, lower quality, higher risk or more remote prospects

**The sky is not falling - the sky is growing
The challenge is cost-effective rate additions**



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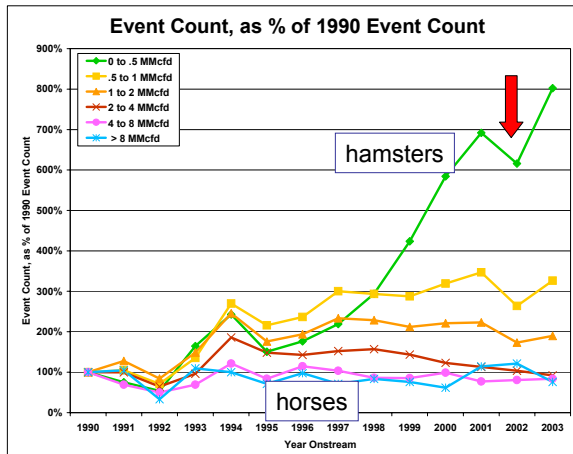
Meeting the Challenge: Growing sources of supply

- Low deliverability zones
- New pools
- New areas
- Tight gas
- Technology driven sources



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Connections by Deliverability Class



- Extraordinary growth in the number of low rate (<0.5 MMcfd) connections since 1995
- The number of connections in the higher rate classes has remained constant since 1995
- Low deliverability connections are price-sensitive

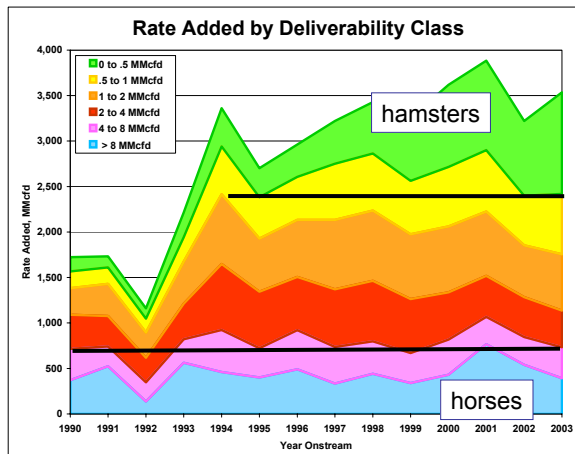
- Higher deliverability connections are not price-sensitive and are the outcome of longer-term, higher risk projects



All activity growth is from low deliverability wells

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Rate Additions by Deliverability Class

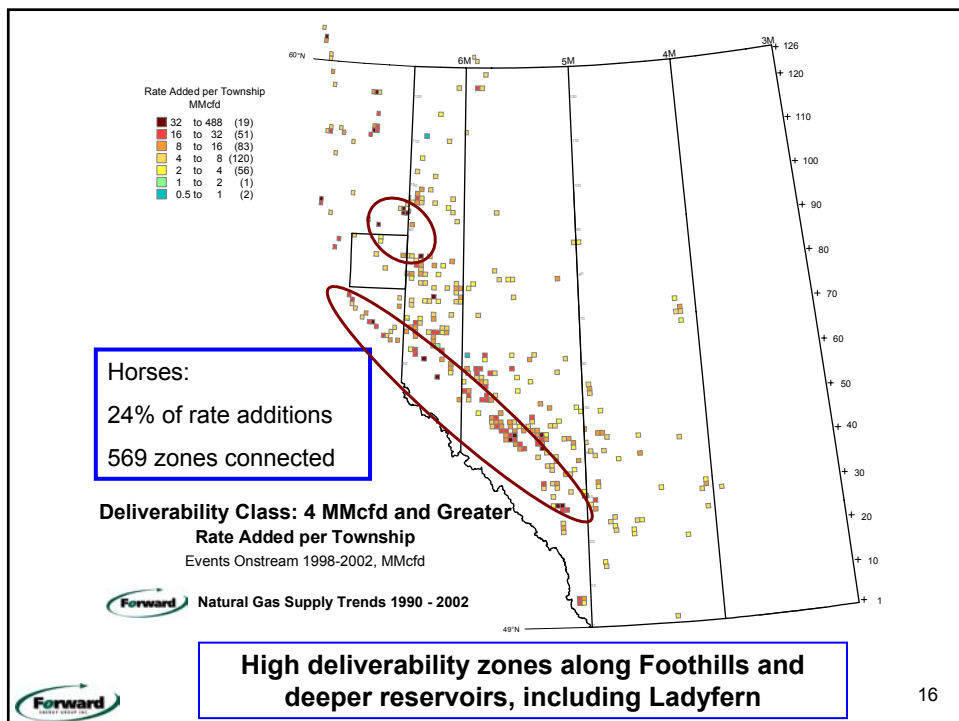
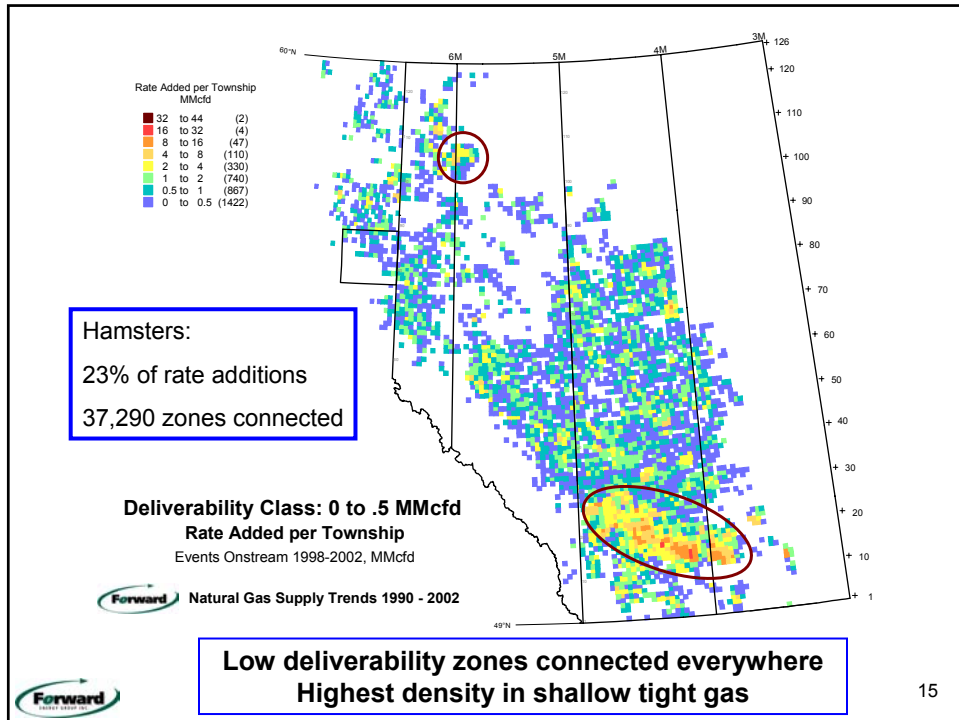


- Rate adds from the lowest deliverability class quadrupled
- Rate additions from low deliverability events (<2.0 MMcfd) increased from 37% to over 67% of annual rate additions in 2002
- High deliverability zones (>4 MMcfd) have maintained relatively constant additions since 1990

Growth in overall rate additions has come increasingly from low deliverability wells



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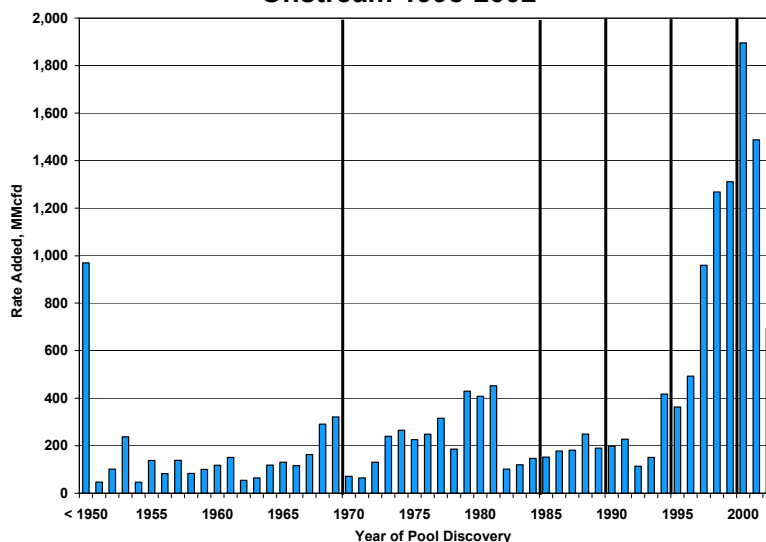
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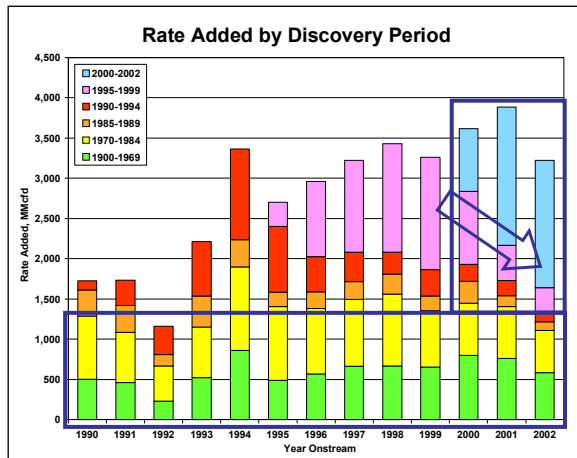
**Rate Added by Pool Discovery Year for Events
Onstream 1998-2002**



Rate additions from recent discoveries

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Rate Additions by Discovery Period



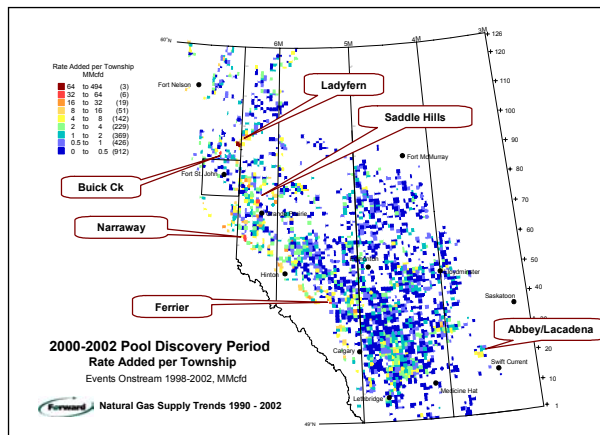
- Half of 98-02 rate additions came from pools discovered since 1994
- Rate additions from new wells in older pools remained constant
- Rate additions from more recently-discovered pools decreased rapidly after discovery
- Technology is helping identify new pools in established plays

Discovery and recognition of new pools is a critical component of growth strategy



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2000-2002 Pool Discovery Period



- Over 4400 pools discovered in over 2100 townships
- Only five discoveries added >35 MMcfd; 2 were Ladyfern pools
- This 3-year discovery period connected gas in over 4 times the number of pools as the 70-year discovery period
- Remaining undiscovered resources – reasons to believe



Many small pool discoveries in recent period

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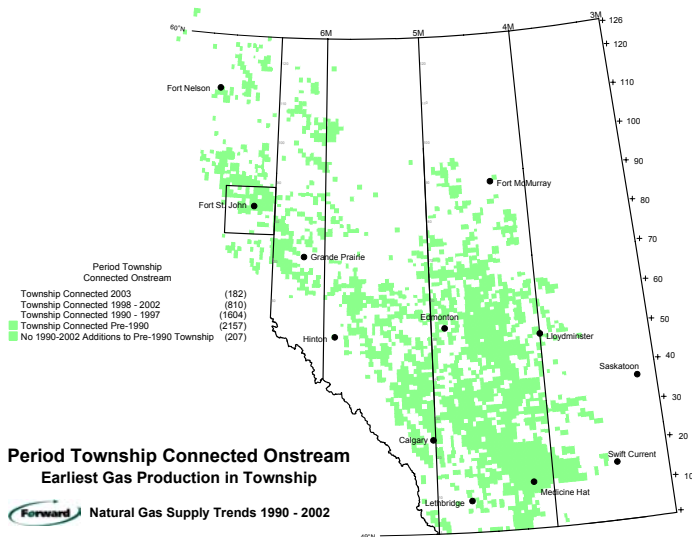
Meeting the Challenge: Growing sources of supply

- Low deliverability zones
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- **New areas**
- Tight gas
- Technology driven sources



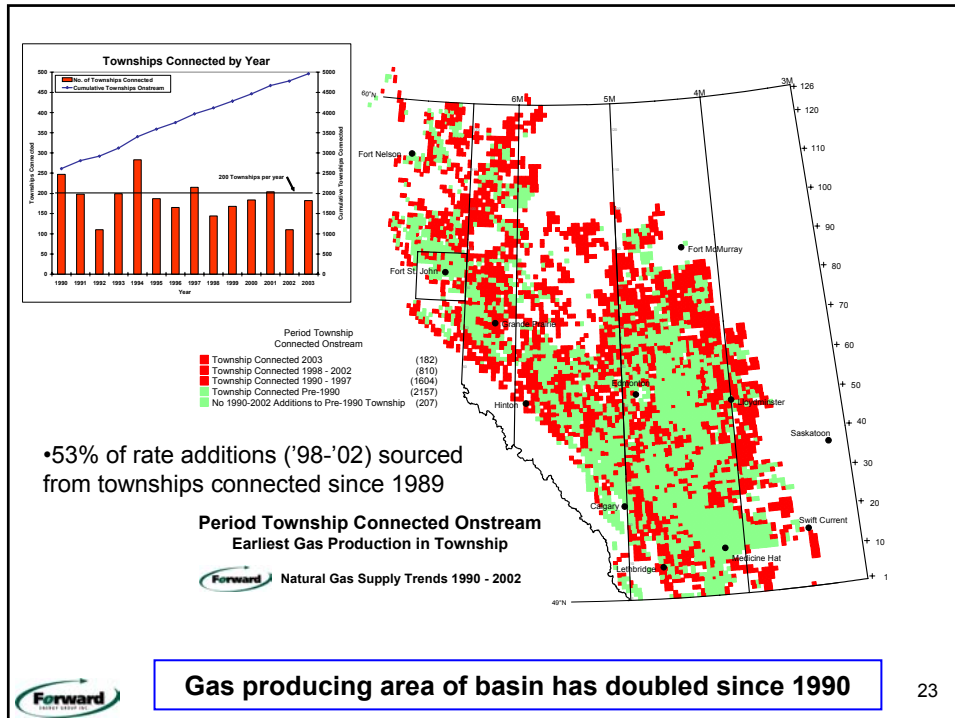
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What new areas have been connected?



Gas producing area of basin to year-end 1989

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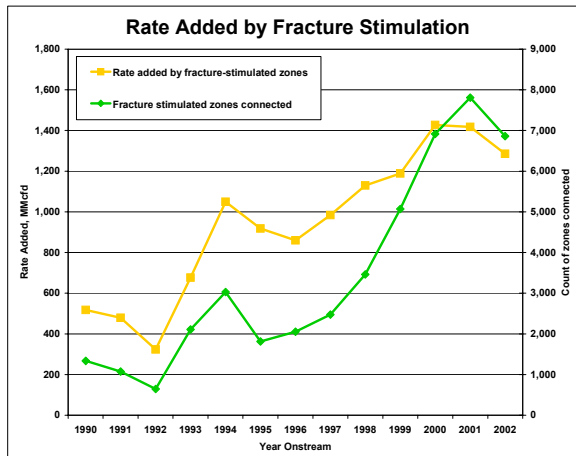
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Meeting the Challenge: Growing sources of supply

- Low deliverability zones
- New pools
- New areas
- Tight gas
- Technology driven sources

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Rate Additions by Fracturing



- Connections of fracture-stimulated events more than doubled between 1998 and 2002
- Fracture-stimulated zones accounted for 37% of the rate added during the focus period

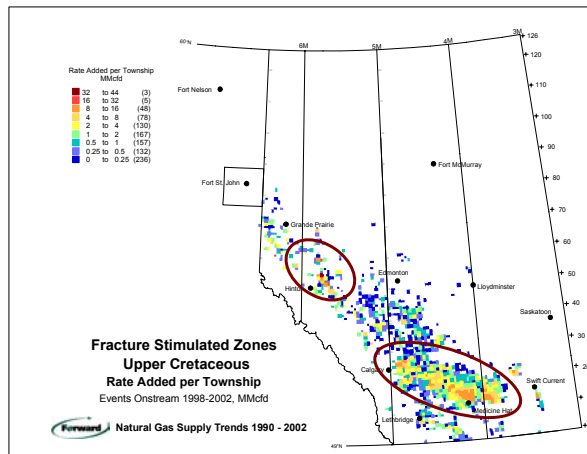
- Most unconventional gas - tight gas and CBM - require fracturing
- We estimate 16% to 25% of 2003 production is tight formation gas

Fracture-stimulated zones are a growing component of supply



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Rate Added by Township



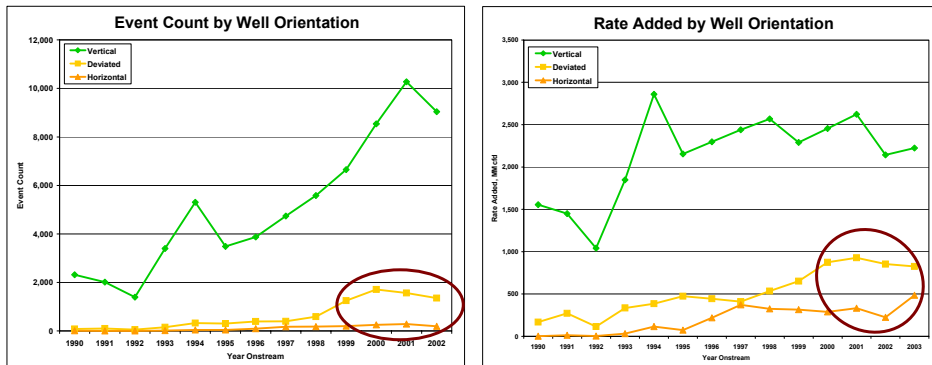
- In the Upper Cretaceous, 75% of the rate added is from fracture stimulated zones
- Concentrations of rate additions:
 - Milk River – Medicine Hat
 - Second White Specks in SE Alberta
 - Cardium and Dunvegan in NW Alberta

Upper Mannville also a significant source



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Well Orientation



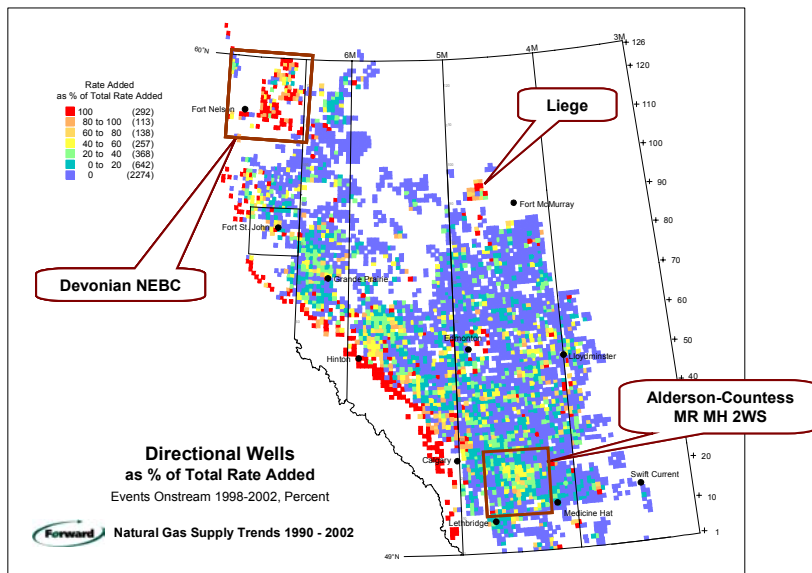
- Activity for directionally-drilled wells, both deviated or horizontal, has held steady at 1800-2000 events per year for 2000-2003
- Activity share declined though (19%-15%)
- In contrast, rate additions from deviated and horizontal wells increased from 30% to 37% by 2003

Increased supply from directional wells but also increased effort and expense



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Directional Wells

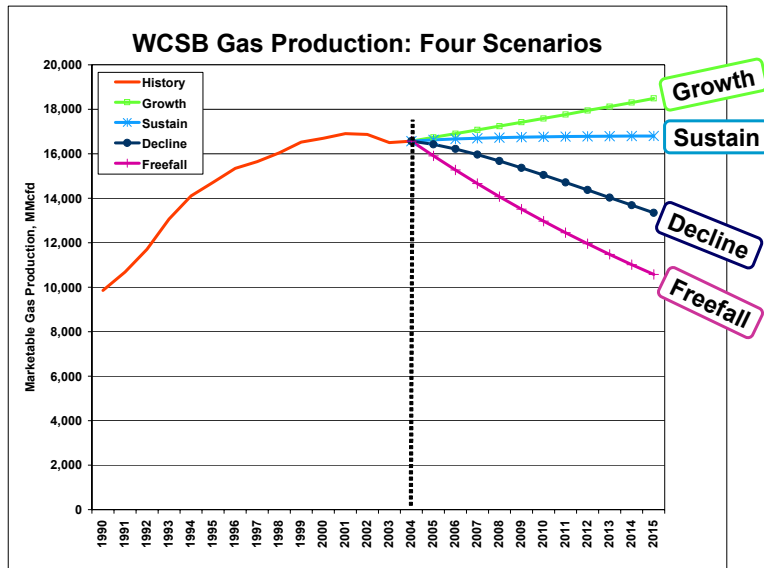


Significant supply source beyond Foothills



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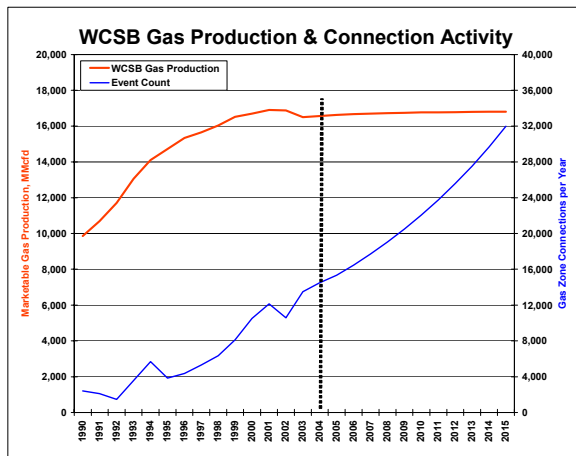
Where is the WCSB headed?



Alternative Scenarios: Sustain and Decline

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Basin Outlook: Sustain



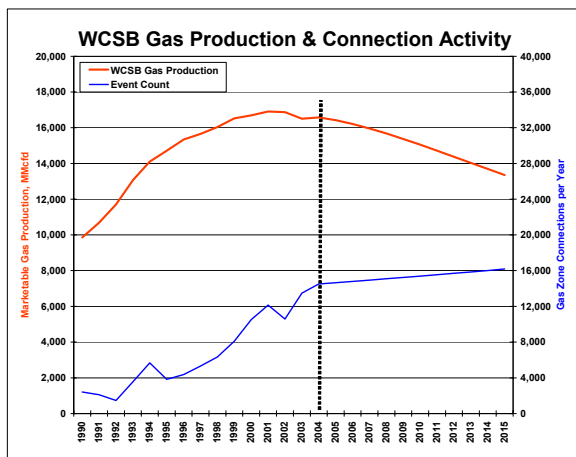
- High price and high investment
- Improving E&P technology
- Increasing supply from low deliverability zones
- Exploration for new pools

- Sustain production at 16.7 Bcfd
- Grow and sustain all types of low deliverability wells
- Significant growth in connection of zones in coalbed methane and shallow tight gas
- Services capacity limitations may not be issue



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Basin Outlook: Decline



- Production declines to 13.3 Bcfd in 2015
- Limited additions in 0.5 to 2 MMcfd deliverability classes; unconventional sources
- Significant decrease in connection of low-deliverability zones in coalbed methane and shallow tight gas

- Lower gas price and lower investment
- Static E&P technology & decreasing capital efficiency
- Supply decreases from lower deliverability classes
- Selective exploration for larger pools



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New Opportunities in the WCSB – Key Messages

- WCSB is important supply source for North America
- Challenge to sustain production profitably
- Increasing production from low deliverability zones
- Higher deliverability zones still underpin supply
- Supply replacement sourced primarily from new pools
- Expanding infrastructure creating new opportunities
- Completion and drilling technology is exploiting unconventional gas
- Outlook for future sensitive to price and costs

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