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

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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
Forward Energy Group Inc

Planning

GOALS

Investments

Portfolio

Plays Properties

Prospects Projects

TACTICS

Discovery Recovery

Better information for strategic decisions

Has production peaked?

- WCSB has been declared mature many times since the 1970s
- With regards to gas – the story has been one of nearly constant growth
- Recent peak at 16.9 Bcfd in 2001; to 16.5 Bcfd in 2003; Rebound to 16.9 Bcfd in 2004

Will production grow again, sustain or decline?
Supply Challenge: Sustain Production

- Total production flat at 16.7 Bcfd ± 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

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
How big is the annual challenge?

- Supply additions were 1.7 Bcf/d in 1990, peaking at 3.9 Bcf/d 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

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
Rate Losses and Rate Additions

- Rate loss from decline has increased from 2.5 Bcf/d to over 3.7 Bcf/d
- Net rate growth is decreasing
- Additions in 2002/03 less than production losses: total rate decreased

Rate losses and rate additions walk the tightrope
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

Meeting the Challenge:
Growing sources of supply

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

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
Low deliverability zones connected everywhere
Highest density in shallow tight gas

Hamsters:
23% of rate additions
37,290 zones connected

Deliverability Class: 0 to .5 MMcf/d
Rate Added per Township
Events Onstream 1998-2002, MMcf/d

Horses:
24% of rate additions
569 zones connected

Deliverability Class: 4 MMcf/d and Greater
Rate Added per Township
Events Onstream 1998-2002, MMcf/d

High deliverability zones along Foothills and
deeper reservoirs, including Ladyfern
Meeting the Challenge: Growing sources of supply

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

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

Rate additions from recent discoveries
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

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
Meeting the Challenge:  
Growing sources of supply

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

What new areas have been connected?

Gas producing area of basin to year-end 1989
Gas producing area of basin has doubled since 1990

Meeting the Challenge:
Growing sources of supply

• Low deliverability zones
• New pools
• New areas
• Tight gas
• Technology driven sources
Fracture-stimulated zones are a growing component of supply

- 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

Rate Added by Fracturing

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Most unconventional gas - tight gas and CBM - require fracturing
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Fracture-stimulated zones are a growing component of supply

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
• 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

Directional Wells

Significant supply source beyond Foothills
Where is the WCSB headed?

### Basin Outlook: Sustain

- 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

- High price and high investment
- Improving E&P technology
- Increasing supply from low deliverability zones
- Exploration for new pools
• Production declines to 13.3 Bcf 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

Basin Outlook: Decline

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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