BC Gas: Challenges and Opportunities

BC Natural Gas Symposium
Canadian Institute
Vancouver

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Outline

• Introduction

• Gas Supply from BC and the WCSB

• Horizontal Wells in BC

• BC Cycle Time Performance

• Unconventional Gas Supply (Tight Gas)

• Summary
Forward Energy Group Inc

**Planning**

**Investments**

- **GOALS**
- **STRATEGIES**
- **TACTICS**

**Portfolio**

**Plays**

**Properties**

**Prospects**

**Projects**

**Discovery**

**Recovery**

Better information for strategic decisions

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Better information for E&P strategies
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WCSB Production

- WCSB: recent peak at 16.9 Bcf/d in 2001, decreased to 16.5 in 2003 and rebounded to 16.7 Bcf/d in 2004
- BC production peaked at 2.7 Bcf/d in 2002, decreased slightly in 2003 and recovered to 2.7 Bcf/d in 2005
- BC share increased from 13% in 2000 to over 16% in 2005

BC is the only province with a growing share of WCSB production
Supply Challenge: Sustain Production

- Total production grew by over 70% from 1990 to 2001
- Total gas production recovering slowly since 2001
- Rate additions from new wells onstream provide growth - Wells onstream since 1989 produce 85% of gas
- Decrease of 300 MMcfd in 2007 due to reduced gas drilling

WCSB Gas Production by Period Onstream

- WCSB supplies 23% of consumption in US and Canada

2006 production estimated at 16.9 Bcfd

Rate Added and Event Count

- Connection activity growing; Supply additions plateaued; 2005 Rate adds lower than 2001
Supply additions coming from everywhere; 21 townships where over 30 MMcfd connected

BC rate additions peaked?
0.72 Bcfd in 2004; 0.67 Bcfd in 2005

Hot spots sourced from a diversity of plays
Rate Additions per Zone Connected

- BC activity has increased, at a greater rate than WCSB
- In 2005, rate added by new BC events declined to 622 Mcfd per connected zone – still almost triple the WCSB average of 212 Mcfd per zone
- 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

More, but lower productivity, opportunities at the economic margin

Top BC Operators

- 80+ operators connected supply in BC in 2003-2005
- Top 3 operators dominated; contributing over 53% of the rate additions
- EnCana, at an average annual rate of additions of 195 MMcfd, delivered 29% of 03-05 BC rate adds
- Three operators with higher rate connections (average >2 MMcfd per event): Talisman, BP, Progress

Few large players dominate; but many other operators
EnCana and Talisman selected to show range in geographic diversification and differences in focus; both companies are high profile in both WCSB and BC-specific gas

EnCana: resource play focus
Talisman: focus in deeper, higher rate plays

EnCana/Talisman: Contrasting styles, both achieve growth
Rate Additions per Zone

- Foothills is most productive region at 2.9 MMcfd per zone (03-05), but declining significantly
- Average rates per zone for all other regions near average of 0.72 MMcfd per zone (03-05)
- Declines in initial rate per zone occurring in all regions

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Rising gas price has enabled extension of economic rate limit
• BC Horizontal wells have provided about 40% of BC rate adds in recent times, now the largest source
• Rate adds per connection from BC horizontals wells have averaged 0.90 MMcfd recently, slightly below the WCSB average

Horizontal well technology – a very important component in BC
Cutbank-Sinclair Region

- Cadomin single zone only connections
- Onstream 2003-05

- Horizontal wells in BC (106)
- Non-horizontal wells in AB-BC (69)

Normalized Production Profiles
Cadomin Play wells only, Cutbank-Sinclair area, Onstream 2003-05

Horizontals: higher initial rate, higher initial decline rate

Horizontals: First year rate: 1.1 MMcf/d EUR: 1.4 Bcf
Non-horizontals: First year rate: 0.5 MMcf/d EUR: 0.9 Bcf
Cumulative frequency of Well EUR by Well Type
Cadomin Play wells only in the Cutbank-Sinclair area

- Horizontals: Average EUR: 1.4 Bcf, Median EUR: 1.3 Bcf
- Non-horizontals: Average EUR: 0.9 Bcf, Median EUR: 0.8 Bcf

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**Median Cycle Time**

- Median cycle time decreased from over 16 months in 1990 to about 3 months in 2001; Jumpshift from connecting drilled wells in inventory to just-in-time drilling
- No improvement in median since since 2001
- BC connections consistently quicker than WCSB overall

**Time is money!**

**BC Cycle Time, by Region**

- For 2003-05, there were 2005 single-event connections from Top 50 Operators in BC; median cycle time of 50 days
- Just-in-time connections, less than 180 days, contributed 85% of the rate additions
- All BC regions, with the exception of BC Foothills had quicker connection times than the entire WCSB

**Quick connections, but at what cost?**
• Most, but not all operators, have quicker connection times in BC
• Select operators consistently outperform their peers – lessons to be learned
• Is it the mix of play types and in-place infrastructure that drives the ‘BC advantage’, or is it the real deadline of winter-only access?

Wide range of cycle time performance – not just across all operators, but within operators

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What’s in a name?

CONVENTIONAL
1. Discrete gas pools in ocean of water
2. Only high quality reservoir accumulates gas in place
3. Discovery is uncertain, recovery is certain
4. Discovery process is efficient
5. R&D to increase success
6. Remaining resource, in small undiscovered pools, is small
7. Official view of WCSB remaining resources

UNCONVENTIONAL
1. Pervasive gas saturated accumulations
2. Very large gas in place in reservoir of all qualities
3. Discovery is certain, recovery is uncertain
4. Recovery is inefficient but improves with technology
5. R&D to improve recovery and characterization
6. Remaining resource in lower quality reservoirs is large
7. US and industry view of WCSB remaining resources

“Glass is mostly empty”
“Glass is mostly full”

Models define how we evaluate potential

Unconventional Gas in the US

- Unconventional gas is the largest supply component in the US
- Tight gas is the largest component of unconventional gas

Tight Gas: Largest single source of US supply since 2000
Better understanding of tight gas is important

Reservoir quality: The 0.1 mD Myth

Tight Formation Designation
- US tax credit program for wells drilled 1977 to 1992
- Area-average in-situ formation permeability < 0.1 mD
- Historical tight gas designation generalized to basin-formation and field-formation – includes areas previously excluded
- New plays included based on USGS continuous accumulation criteria – not screened by permeability criteria
- In-situ permeability is difficult to measure and average
- Average permeability is only one of several factors that determine flow rate, ultimate recovery and economics

US tight gas plays include all reservoir qualities
Reservoir quality: The 0.1 mD Myth

Rate - Depth Limits for Tight Formation Gas

- Rate-depth limits classified formations with low productivity for their depth as tight formation gas
- Shallow biogenic gas

US tight gas plays include all reservoir qualities

Tight gas not reported in Canada

- Tight formation gas is not defined and distinguished from "conventional"
- Current tight gas production and size of future opportunity remain uncertain
- Geographic and stratigraphic distribution and reservoir characterization of tight gas plays not available in public reports
- Tight gas resource potential not included in CGPC, federal or provincial agency estimates
- Supply potential and opportunities to increase tight gas supply not founded on consistent definition, play characterization and resource estimates

GIP estimates up to 1500 Tcf in the early 1980s
Is the resource really there?
**Definition**

**Definition:** All gas resources occurring as free gas in the pores of clastic and carbonate reservoirs in regionally-pervasive continuous gas accumulations will be defined as tight gas resources. *Adopted working definition.*

The resource potential covers a wide **spectrum of reservoir qualities** within these gas accumulations.

**Regionally-pervasive gas accumulations** are classified as tight gas areas and reviewed in the following priority:

- Deep Basin trap
  - Shallow biogenic gas
  - Jean Marie Fm, B.C.
  - Additional accumulations

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**Plays and Characterization**

**Production by Tight Gas Region**

*Three major tight gas regions – all on growth trends*
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Profitable Production Replacement

- F&D costs have been increasing rapidly
- Decreasing rate additions and reserves per well has been the major driver of increased F&D costs
- Cost inflation has been a recent contributor
- Increased gas commodity prices supported investment at the increased F&D costs until 2006
- Exchange rate ($US/$C) also contributing negatively
- Current slowdown in drilling will result in lower supply, higher gas prices and, in time, lower input costs
- Operators must select investments where profitability is sustainable through volatile commodity price cycles and inflationary cost pressures

Summary

- The output from the WCSB has plateaued at 16-17 Bcfd; BC at 2.7 Bcfd
- There are growth stories within the large and dynamic mix of plays / areas / technologies etc.
- Horizontal well technology has been particularly significant in BC
- As shown by the cycle time analysis, operational performance gains can be achieved internally; it is not solely a resource endowment issue
- Unconventional gas production is growing while production from conventional sources declines
- Regionally pervasive gas accumulations host tight gas resources, regardless of the reservoir quality
  - The 0.1 mD cutoff is a myth

Impact on supply will be evolution, not revolution
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