

BC Gas: Challenges and Opportunities

***BC Natural Gas Symposium
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Bob Dixon

www.forwardenergy.ca

bob.dixon@forwardenergy.ca

403.261.1019

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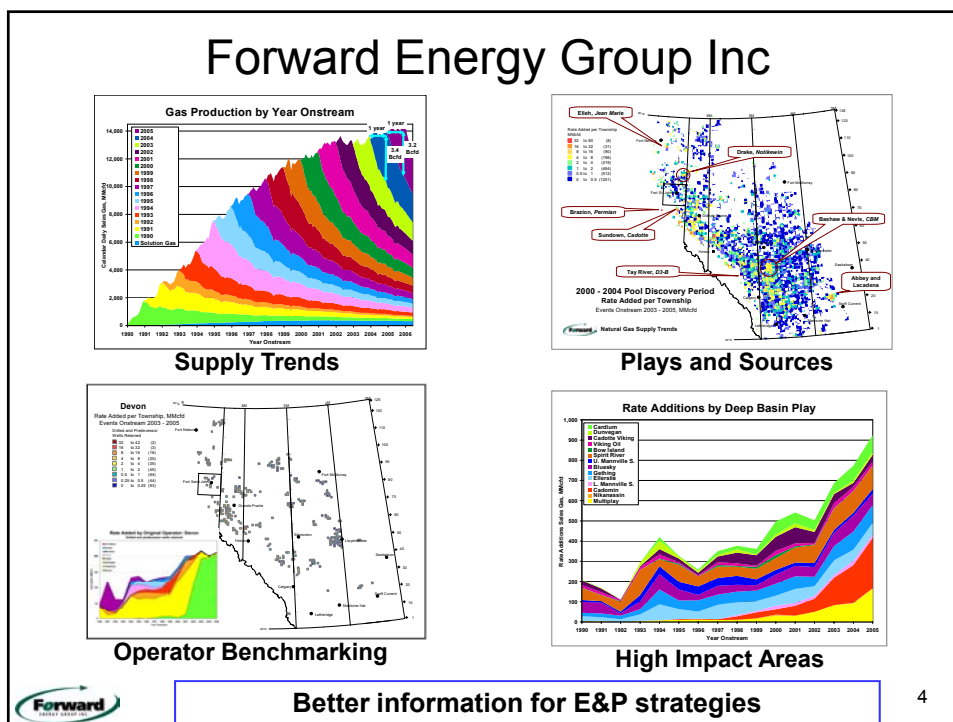
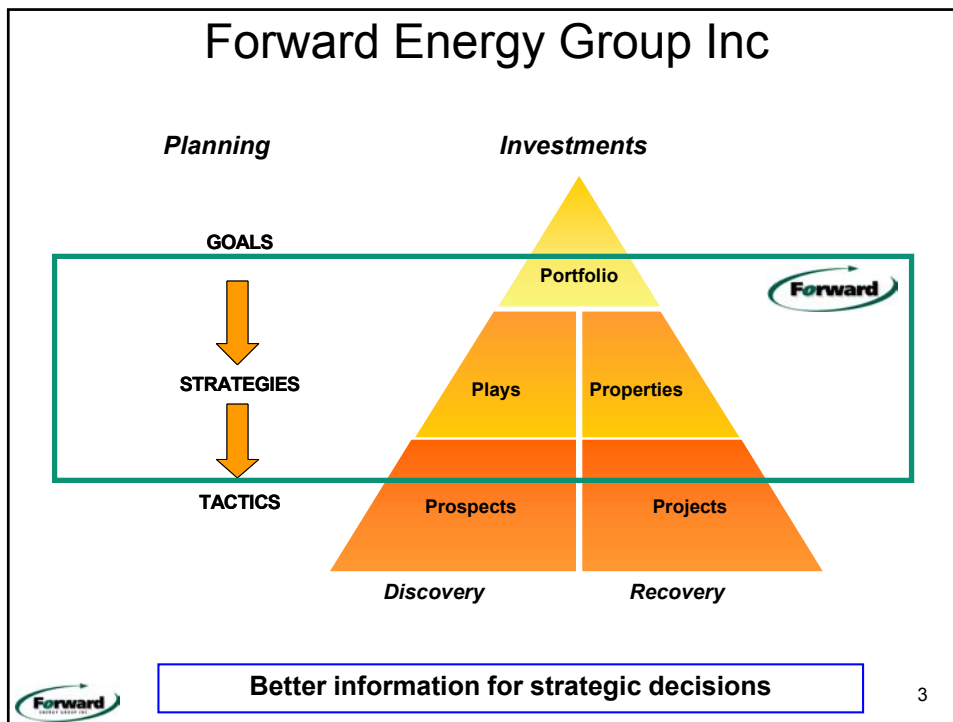
1

Outline

- **Introduction**
- Gas Supply from BC and the WCSB
- Horizontal Wells in BC
- BC Cycle Time Performance
- Unconventional Gas Supply (Tight Gas)
- Summary



2



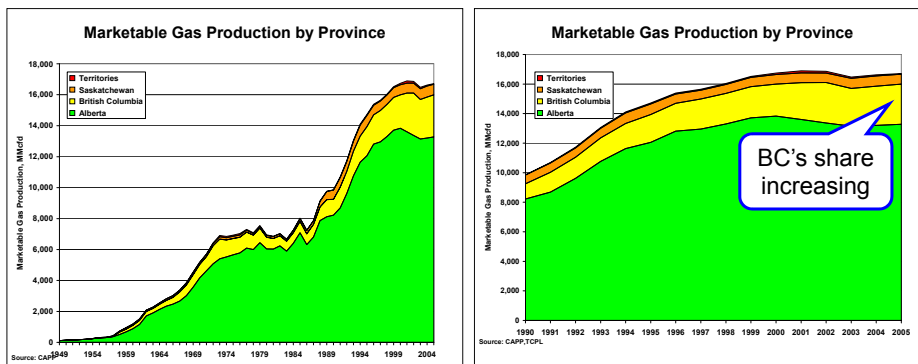
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5

WCSB Production



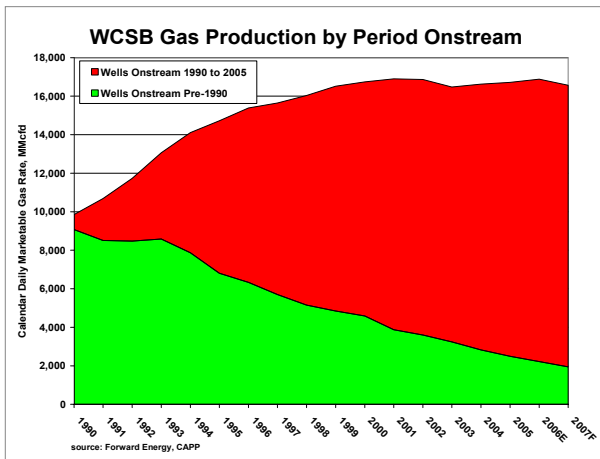
- WCSB: recent peak at 16.9 Bcfd in 2001, decreased to 16.5 in 2003 and rebounded to 16.7 Bcfd in 2004
- BC production peaked at 2.7 Bcfd in 2002, decreased slightly in 2003 and recovered to 2.7 Bcfd in 2005
- BC share increased from 13% in 2000 to over 16% in 2005

BC is the only province with a growing share of WCSB production



6

Supply Challenge: Sustain Production



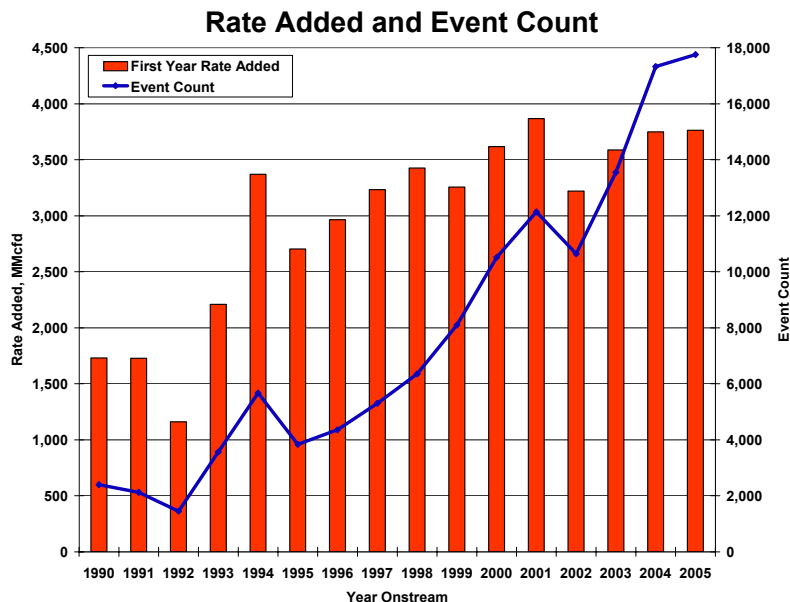
- Total production grew by over 70% from 1990 to 2001
- Total gas production recovering slowly since 2001
- Rate additions from new wells onstream provide growth - Wells onstream since 1989 produce 85% of gas
- Decrease of 300 MMcfd in 2007 due to reduced gas drilling

- WCSB supplies 23% of consumption in US and Canada



2006 production estimated at 16.9 Bcfd

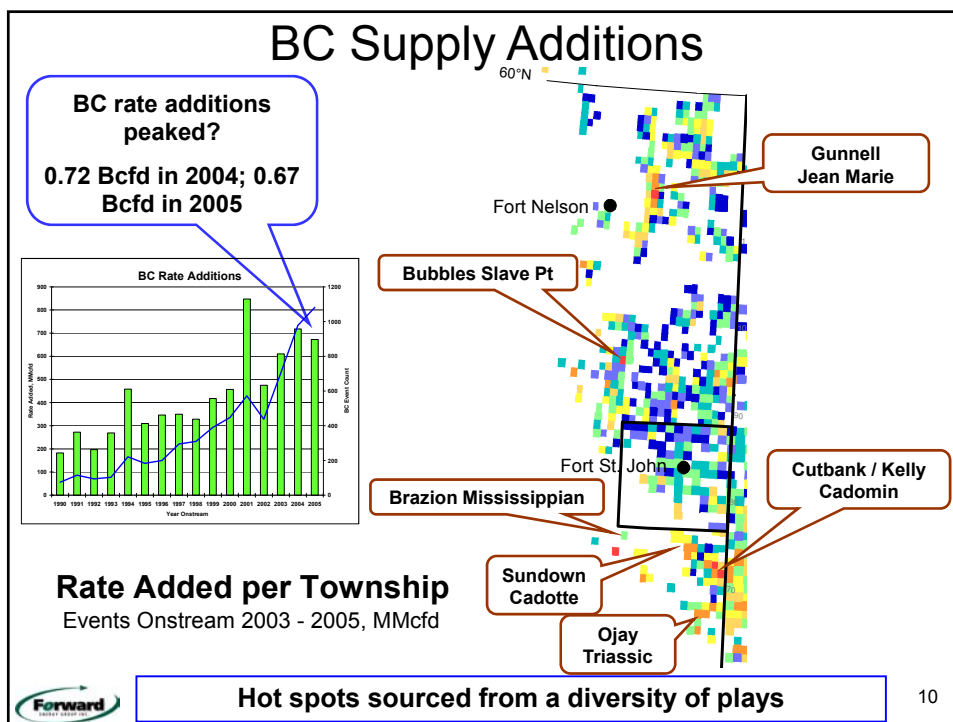
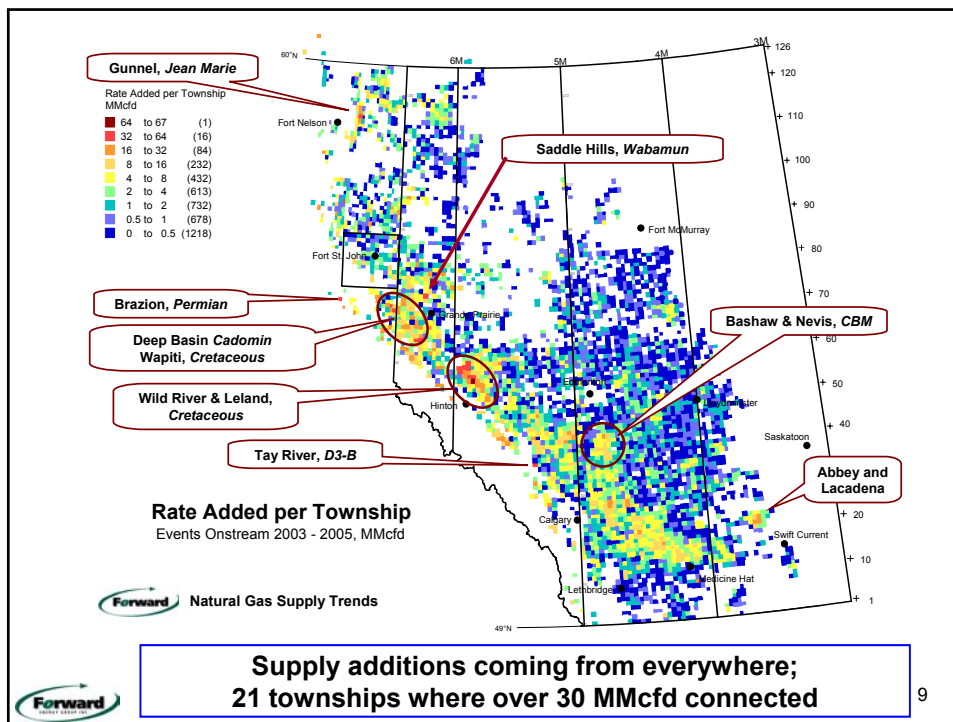
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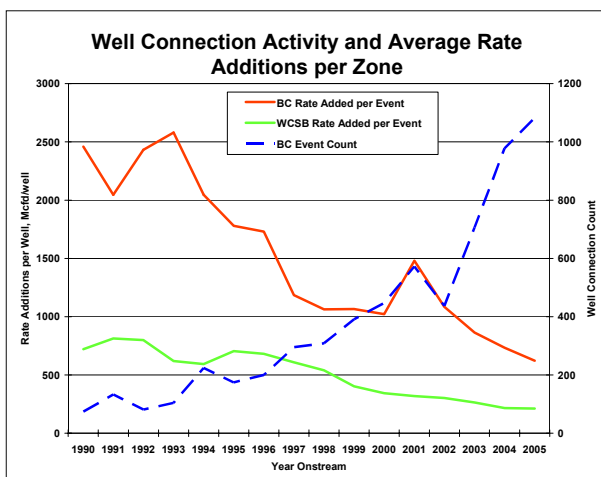
**Connection activity growing; Supply additions plateaued;
2005 Rate adds lower than 2001**



8



Rate Additions per Zone Connected



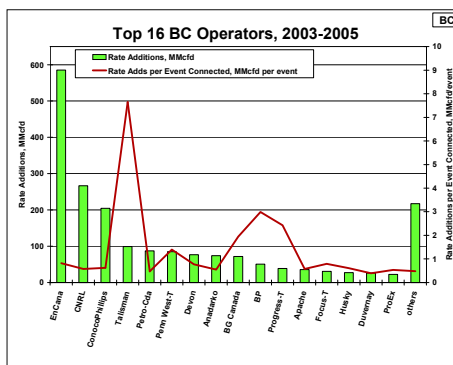
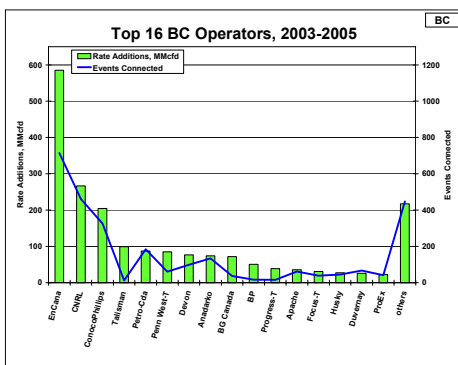
- BC activity has increased, at a greater rate than WCSB
- In 2005, rate added by new BC events declined to 622 Mcfd per connected zone – still almost triple the WCSB average of 212 Mcfd per zone
- Threshold size of an economic well decreased as gas price and netback increased
- Expanded opportunity set: smaller, higher cost, lower quality, higher risk or more remote prospects



More, but lower productivity, opportunities at the economic margin

11

Top BC Operators



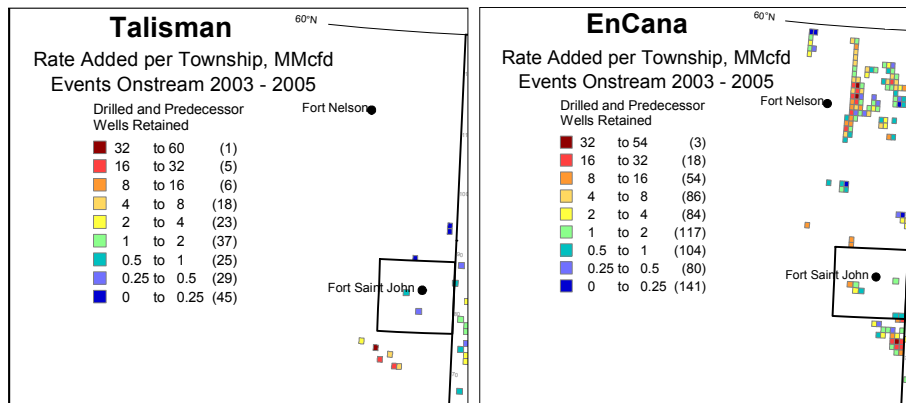
- 80+ operators connected supply in BC in 2003-2005
- Top 3 operators dominated; contributing over 53% of the rate additions
- EnCana, at an average annual rate of additions of 195 MMcf/d, delivered 29% of 03-05 BC rate adds
- Three operators with higher rate connections (average >2 MMcf/d per event):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



Few large players dominate; but many other operators

12

Geographic Trends

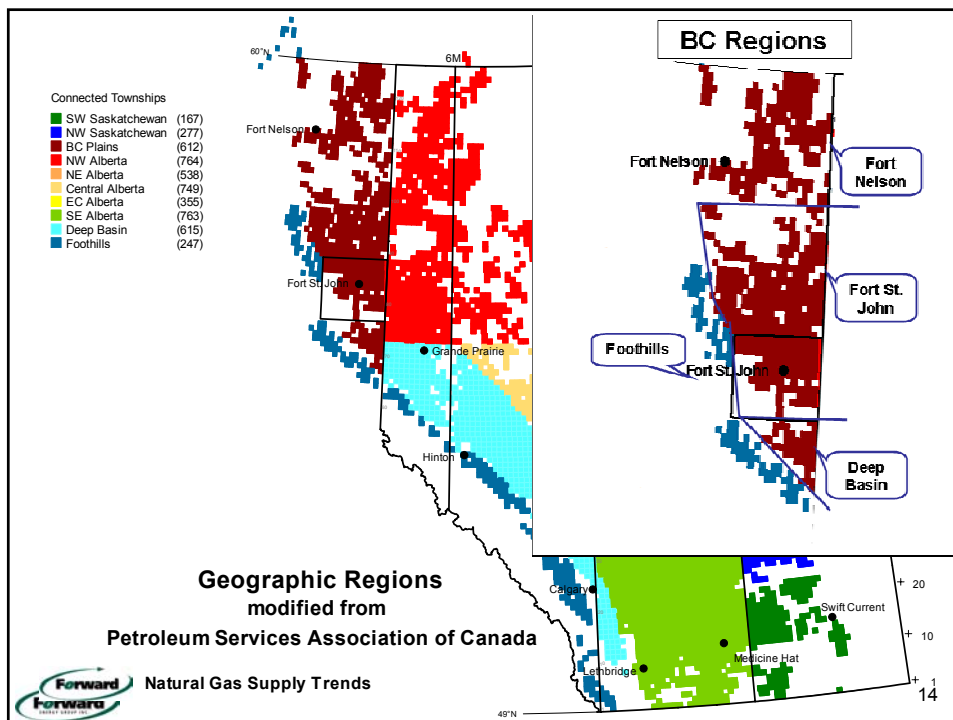


- EnCana and Talisman selected to show range in geographic diversification and differences in focus; both companies are high profile in both WCSB and BC-specific gas
- EnCana: resource play focus
- Talisman: focus in deeper, higher rate plays

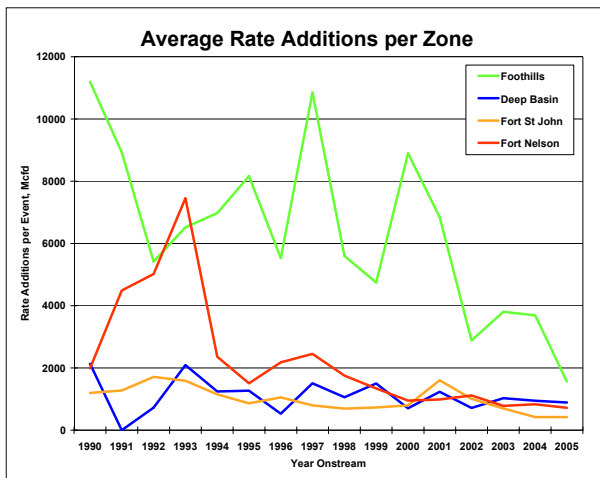


EnCana/Talisman: Contrasting styles, both achieve growth

13



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



Rising gas price has enabled extension of economic rate limit ⁵

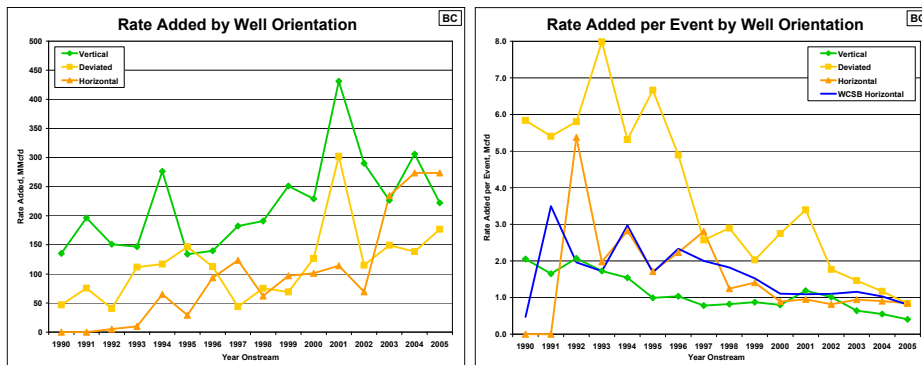
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16

Rate Additions by Well Orientation



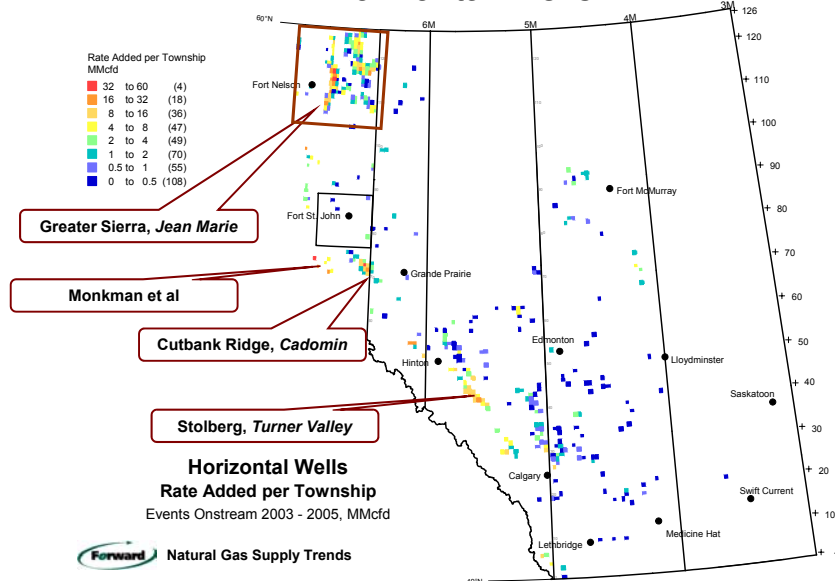
- BC Horizontal wells have provided about 40% of BC rate adds in recent times, now the largest source
- Rate adds per connection from BC horizontal wells have averaged 0.90 MMcf recently, slightly below the WCSB average

Horizontal well technology – a very important component in BC



17

Horizontal Wells



Significant supply source beyond Foothills

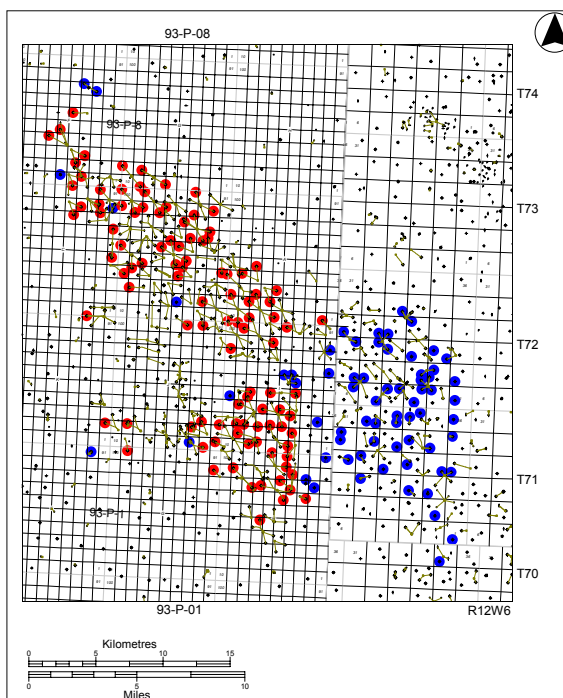


18

Cutbank-Sinclair Region

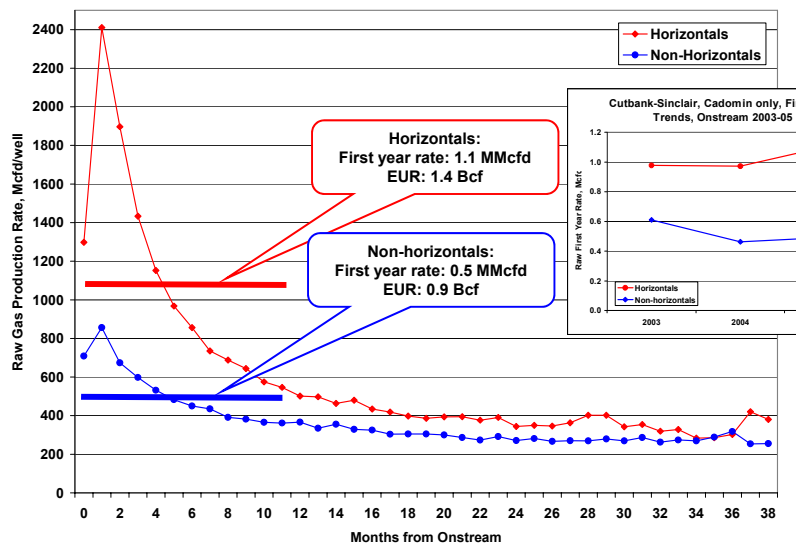
- Cadomin single zone only connections
- Onstream 2003-05

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



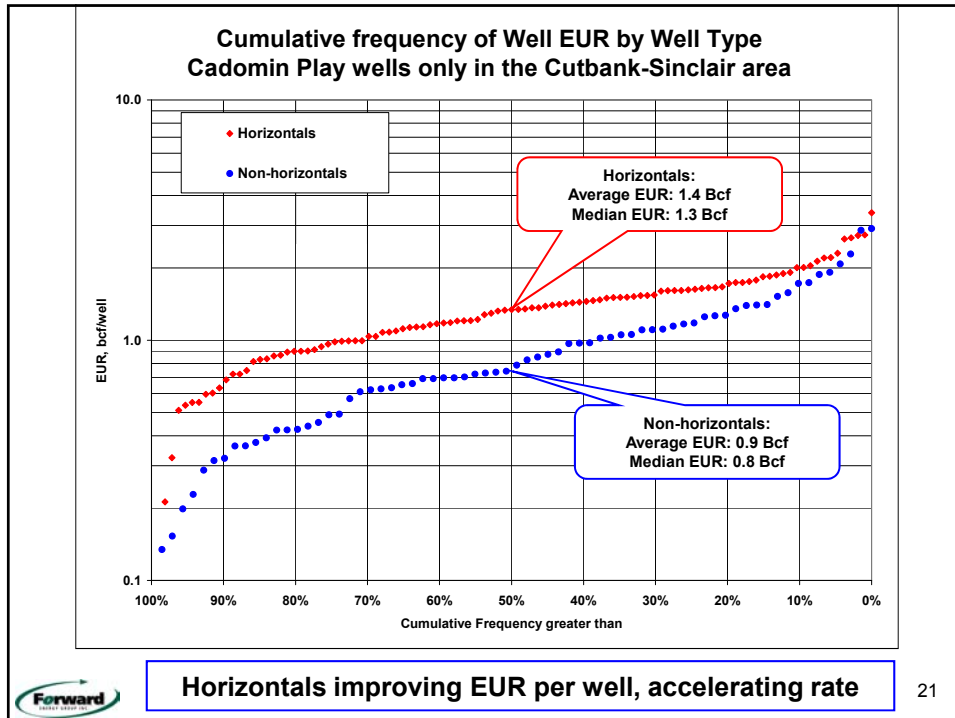
Normalized Production Profiles

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



Horizontals: higher initial rate, higher initial decline rate

20

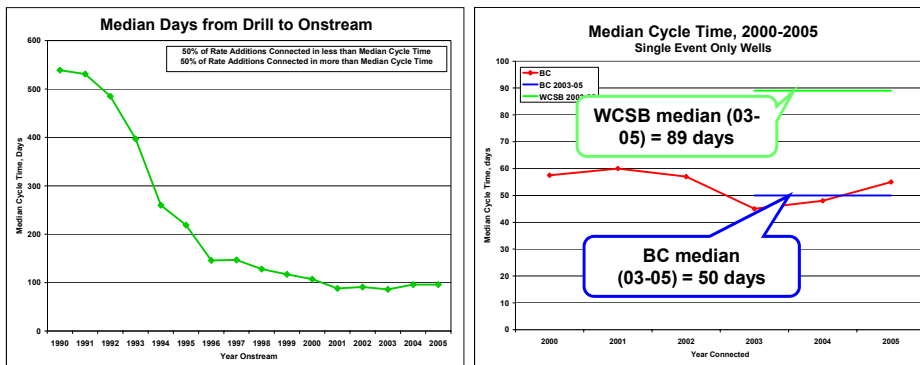


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22

Median Cycle Time



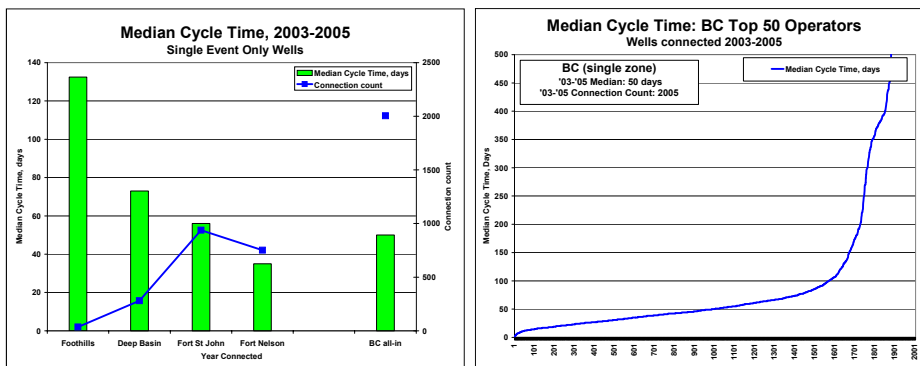
- Median cycle time decreased from over 16 months in 1990 to about 3 months in 2001; Jumpshift from connecting drilled wells in inventory to just-in-time drilling
- No improvement in median since 2001
- BC connections consistently quicker than WCSB overall



Time is money!

23

BC Cycle Time, by Region



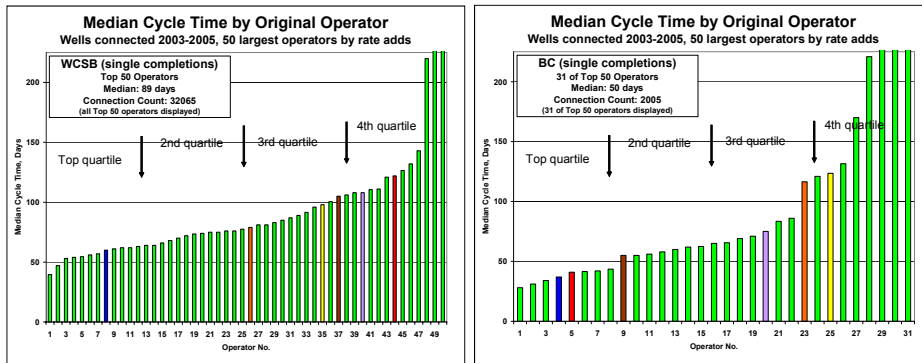
- For 2003-05, there were 2005 single-event connections from Top 50 Operators in BC; median cycle time of 50 days
- Just-in-time connections, less than 180 days, contributed 85% of the rate additions
- All BC regions, with the exception of BC Foothills had quicker connection times than the entire WCSB



Quick connections, but at what cost?

24

BC Cycle Time, by Operator



- 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



25

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26

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

"Glass is mostly empty"

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

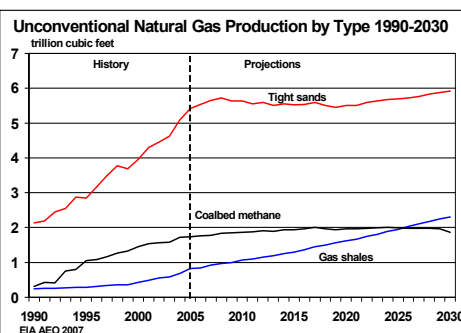
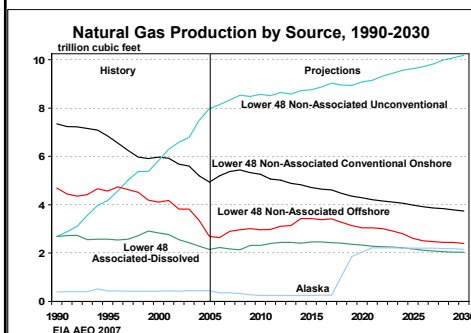
"Glass is mostly full"



Models define how we evaluate potential

27

Unconventional Gas in the US



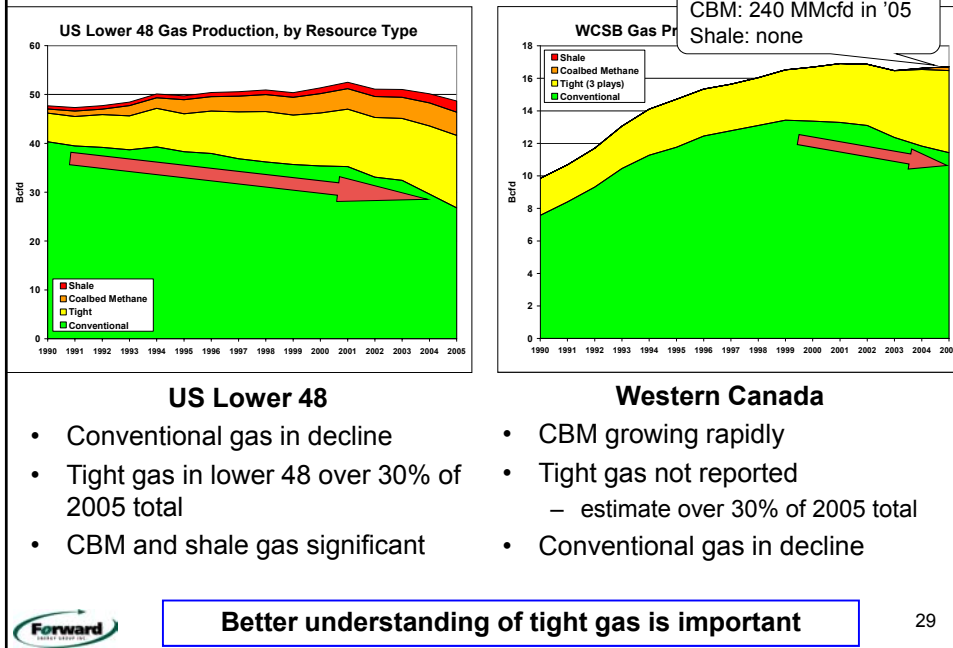
- Unconventional gas is the largest supply component in the US
- Tight gas is the largest component of unconventional gas



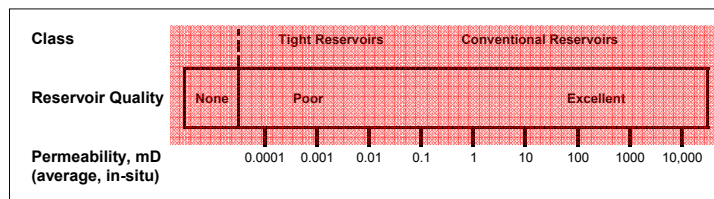
Tight Gas: Largest single source of US supply since 2000

28

Gas Production Profiles



Reservoir quality: The 0.1 mD Myth



Tight Formation Designation

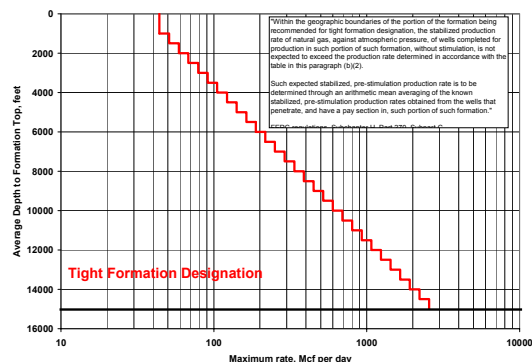
- US tax credit program for wells drilled 1977 to 1992
- Area-average in-situ formation permeability < 0.1 mD
- Historical tight gas designation generalized to basin-formation and field-formation – includes areas previously excluded
- New plays included based on USGS continuous accumulation criteria – 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

30

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

31

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?**

32

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

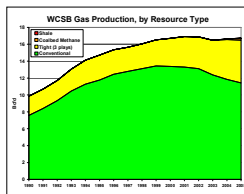
Regionally-pervasive gas accumulations are classified as tight gas areas and reviewed in the following priority:

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

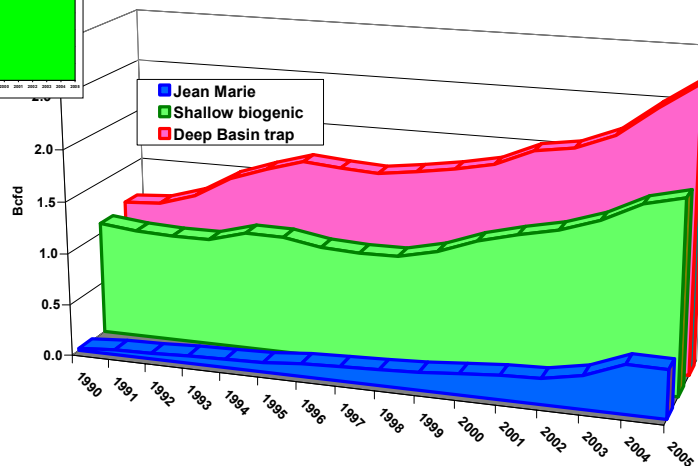


33

Plays and Characterization



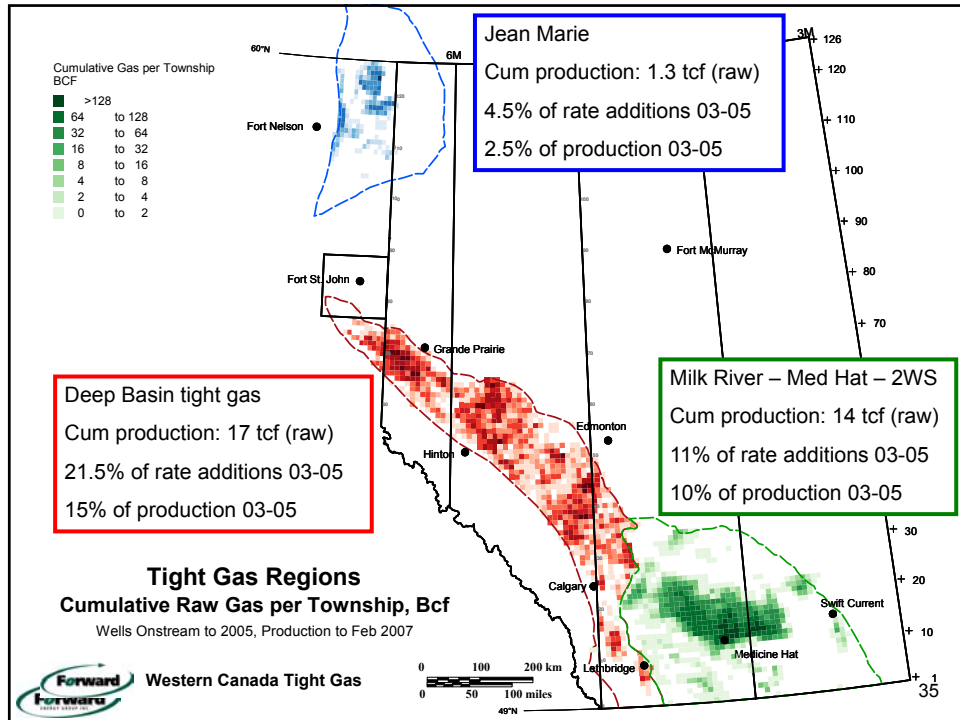
Production by Tight Gas Region



Three major tight gas regions – all on growth trends



34



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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



37

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

38

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39