Will We Have the Right Stuff?

*Current and Future Natural Gas Supply as Feedstock*

Dave Flint and Bob Dixon

CERI Petrochemical Conference
June 4, 2007

Current and Future Gas Supply Trends

• Western Canada supply
  – Current trends
  – Fundamentals of short term supply
  – Is unconventional gas the right stuff?
• Canadian supply in longer term
• US supply projections
• LNG – the genie in the bottle
Forward Energy Group Inc

Gas Production by Year Onstream

Supply Trends

Plays and Sources

Operator Benchmarking

High Impact Areas

Better information for E&P strategies

Gas Supply Regions in North America

WCSB
- Largest natural gas supply region in North America
- Produces 6 Tcf per year
- Supplies over 23% of North American consumption

LOWER 48
- Supplies over 72% of North America’s demand
- Produces 19 Tcf per year

LNG
- Future swing supply source

Balancing Natural Gas Policy, NPC (2003)
Current and Future Natural Gas Supply as Feedstock

CERI Petrochemicals Conference
June 2007

Supply by Period Onstream

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

2006 production estimated at 16.9 Bcfd

Competing Forces on Gas Supply

Production Lost

Production Rate \times \text{Composite Decline Rate}

- Changing slowly
- Low control

Production Additions

Wells \times \text{Rate Added per Well}

- Changing rapidly
- High operator control

Investment Environment
Profitability
Gas prices
F&D costs
Capital efficiency
Cash flow
Alternative investments
Portfolio
New opportunities
Technology

Source: Forward Energy, CAPP
Current and Future Natural Gas Supply as Feedstock

WCSB Rate Losses and Rate Additions

- Rate loss from decline increased from 2.5 Bcfd to 3.9 Bcfd in 2004
- Annual rate loss has averaged 3.7 Bcfd since 2001
- Net rate added has been decreasing
- 2002 correction may be a useful model for 2007

Rate Additions by Year Onstream

- Supply additions were 1.7 Bcfd in 1990, rising to 3.9 Bcfd in 2001,
- Rate additions averaged 3.6 Bcfd from 2001 to 2005
- Events are the new connections that provided the new rate additions
- Connections lag drilling

- Since 2000, rate additions static but the number of connections has increased 69%—this is the treadmill!
• Production replacement per foot drilled has decreased by 12% per year
• In 2005, the same event connected and foot drilled resulted in only 30% of the 1995 rate additions per unit
• Supply from previously-unprofitable, lower deliverability opportunities increased in response to higher prices and improved technology

Decreasing results for same activity is the consistent driver of F&D cost increase

• Total drilling capital / Total feet drilled
• Cost per unit has been increasing at 9% per year since 1999
• Rapid cost increases in 2005 (14%) and continuing at least 15% into 2006

Cost inflation is accelerating, driving F&D costs
Current and Future Natural Gas Supply as Feedstock

Gas F&D cost

- Gas-directed capital / extrapolated recovery in newly-connected zones
- Increasing at 21% per year since 1999
- Most of F&D cost increase is in lower EUR per well

- To sustain investment return, increasing F&D cost must be matched by increasing netback and therefore, increasing price

Increasing costs threaten profitability and investment

Gas Price

- Increased at > 22% per year between 1999 and 2005
- Commodity price increases supported projects despite increased F&D cost
- Estimated 20% decrease in price in 2006

- Rate additions at increasing F&D costs sustained by increasing prices
- Activity and rate adds will decrease when price decreases

What happens when gas prices decrease?
Current and Future Natural Gas Supply as Feedstock

CERI Petrochemicals Conference
June 2007

Drilling Response

- Active gas rigs dropped below 2005 levels in August 2006
- Dropped below 2004 levels in October
- Year to date 2007 active gas rigs are 56% of the comparable 2006 period
- Operators have announced reduced shallow gas and CBM programs
- Lower utilization rate of shallow rigs

Rapid response after a record first half of 2006

Drilling Response

- Connections and completions flat 2004 to 2006
- CAODC and PSAC forecasts 2007 gas completions down 20% to 30%
- We assume a 10% decrease in activity
- Decrease in rate added depends on rate added per new event

Lower drilling = lower production
Current and Future Natural Gas Supply as Feedstock

CERI Petrochemicals Conference
June 2007

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
- Current slowdown in drilling will result in lower supply, higher gas prices and, in time, lower input costs
- WCSB gas F&D costs are less competitive with US basins due to stronger Canadian dollar

Gas Accumulation Types

Will unconventional gas rescue WCSB supply?
What's in a name?

**CONVENTIONAL**
1. Discrete gas pools in pervasively water saturated rock - aquifer
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 - gasifer
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. Industry view of WCSB remaining resources – believed in US

“Glass is mostly full”

---

**Gas Production Profiles**

**US Lower 48**
- Conventional gas in decline
- Tight gas in lower 48 over 30% of 2005 total
- CBM and shale gas significant

**Western Canada**
- CBM growing rapidly
- Tight gas not reported
- Conventional gas in decline

---

Models define how we evaluate potential

Better understanding of unconventional gas required
Plays and Characterization

Production by Tight Gas Region

Three major tight gas regions – recent growth trends

Jean Marie
Cum production: 1.3 tcf (raw)
4.5% of rate additions 03-05
2.5% of production 03-05

Marginal economics?
Reduced drilling activity in CBM, shallow gas and the Jean Marie plays in 2006-07

Deep Basin tight gas
Cum production: 17 tcf (raw)
21.5% of rate additions 03-05
15% of production 03-05

Milk River – Med Hat – 2WS
Cum production: 14 tcf (raw)
11% of rate additions 03-05
10% of production 03-05.
Current and Future Natural Gas Supply as Feedstock

Illustrative long term supply outlook for Canada

- Continuing Trends preliminary scenario
- Decline of WCSB conventional & limited replacement
- Unconventional from WCSB grows
- Mackenzie onstream in 2012, East Coast LNG earlier

Base case assumes business as usual, 2.8% economic growth
Assumes gas price of $7/mcf US Henry Hub

Long term supply/demand outlook for United States

- Gas consumption increases in medium term until electrical switches to coal
- US gas production grows despite recent declines in Gulf
- Pipeline imports from Canada decrease
- LNG is plug number to meet consumption

Base case assumes policy neutral: no carbon taxes affecting coal
Forecasts prices of $5-$6/mcf Henry Hub ($US 2005) over period

Greenhouse gas policies would limit new coal generation
Current and Future Natural Gas Supply as Feedstock

CERI Petrochemicals Conference
June 2007

US Dry Gas Production base case

Natural Gas Production by Source, 1990-2030

- Unconventional growth is slower, gas shales growing
- Short-term production hiccup
- Reverse declines in Gulf of Mexico by tying in Deepwater oil and gas fields
- Assumes Alaska pipeline in 2018

Actual US production flat despite record onshore drilling
Gulf of Mexico offshore production declining – not just hurricanes!

A generous production forecast

LNG Supply

Unconventional largest single source of supply
Will We Have the Right Stuff?

- Challenge to sustain production profitably in WCSB
  - More feet drilled for less gas production and reserves
  - Supply costs and F&D costs are increasing
  - Uncompetitive costs and economics for WCSB gas projects will reduce reinvestment

- Unconventional gas, Mackenzie and LNG
  - Will be required to replace declining WCSB output
  - Project economics are challenging, supply timing uncertain

- US production is forecast not to meet consumption

- LNG will be the swing source for North America

Yes . . . but volatile supply won’t be cheap!

Will We Have the Right Stuff?

Current and Future Natural Gas Supply as Feedstock

dave.flint@forwardenergy.ca

CERI Petrochemical Conference
June 4, 2007