Prudent Development

Realizing the Potential of North America’s Abundant Natural Gas and Oil Resources

The impact of recent trends in North American onshore natural gas resource development

CSIS
February 18, 2014

Andrew Slaughter, Vice President Energy Research, IHS and Chair NPC Resource and Supply Task Group

Douglas Tierney, Vice President Business Development, Encana and leader of NPC Onshore Gas Supply Sub-Group
In 2011, the NPC Study Concluded that “North American Natural Gas Resources Have the Potential to Supply the Market for Decades”

High demand, advanced technology, moderate development cost
The NPC further inferred that “North American Natural Gas Can Meet Even the Highest Potential Demand”
Significant new natural gas supply data is now available to bolster the NPC 2011 findings

- Three more years of data is available since the National Petroleum Council Prudent Development study was published
- Gas production performance continues to be very strong despite lower prices
- From a “bottom-up” point of view:
  - New discoveries have been (and continue to be) made
  - Associated gas from liquids-rich plays has become much more significant than observed three years ago
  - More recent studies, like the PGC and EIA/ARI, continue to increase their gas resource estimates, which are now consistent with the NPC, MITei, and RSTG data used in the original study

The NPC gas supply low case (Case 1) no longer fits observed historical trends
U.S. Plus Canada Onshore Production Profile to 2009

USL-48 + Canada Onshore Natural Gas Production History

- Note slope change as unconventional CBM and tight gas start to contribute
- U.S. Peak in 1973
- CBM and tight gas start to contribute (est pre-1997)
- Shale gas starts to contribute

Note: Data to 2009, as used in NPC study published in 2011

data sources: US EIA, USGS, CAPP, NEB Canada, Cenikoz

North American Resource Development Study
U.S. Plus Canada Onshore Production Profile updated to 2012

USL-48 + Canada Onshore Natural Gas Production History

- **Total**
- **Conv**
- **Old Tech UC**
- **New Tech UC (shale)**
- **Conv + Old Tech UC**

**Note:** Data updated to include 2010 to 2012 actual production.

**Note slope change as unconventional CBM and tight gas start to contribute.**

**U.S. Conventional Peak in 1973**

**CBM and tight gas start to contribute (est pre-1997)**

**Shale gas starts to contribute**

**2012 up to 77 BCFD, not at peak capacity, note impact as modern shale plays contribute.**

**Data sources:** US EIA, USGS, CAPP, NEB Canada, Cedigaz, IHS CERA.

North American Resource Development Study
NPC Supply Cases
Case 1 no longer applies; 1,200 TCFG available at < $6 supply cost

USL48+CA Onshore Total Year-End 2009 (TCF)
Varying Resource Base and Technology, 2007 Cost Index

Notes:
1. History: $Money of the day (source: EIA)
2. Stack: $Supply Cost @10%

Over time these curves are trending down to the right – i.e. more resource available at a lower cost

Approximate price at which production remains flat

+1,200 TCF Available at $4.00-$5.50

~1,200 TCF Produced to date

North American Resource Development Study
Basins with significant new unconventional discoveries since 2008 are likely to increase the unconventional fraction of total resources to >90%

- unconventionals have the potential to account for up to 10 times the conventional recoverable resource
Conclusions

• Cumulative conventional natural gas production to date is about 1000 Tcf

• Recent and expected growth in unconventional recoverable resource estimates equivalent to 90% of the total US natural gas resource could therefore support ultimate onshore natural gas recovery of up to 10,000 Tcf

• This is over twice the NPC high case (Case 3) for ultimate recoverable resource of 4,656 Tcf

• The NPC low gas supply case is not supported by recent and current trends and should be disregarded

• Pace and ultimate scope of recovery will depend on economics, market conditions and regulatory factors

• The NPC conclusion that natural gas market growth should not be constrained by resource availability is re-confirmed