



Exploring the Future for Natural Gas Supply and Demand – ICF's Winter Outlook

**U.S. and Canada Gas Market Overview
Based on a Recent ICF Gas Market Model Base Case**

**CIBO Technical Focus Group, Environmental & Energy
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Kevin R. Petak
Vice President, Gas Market Modeling
ICF International
703-218-2753
kpetak@icfi.com

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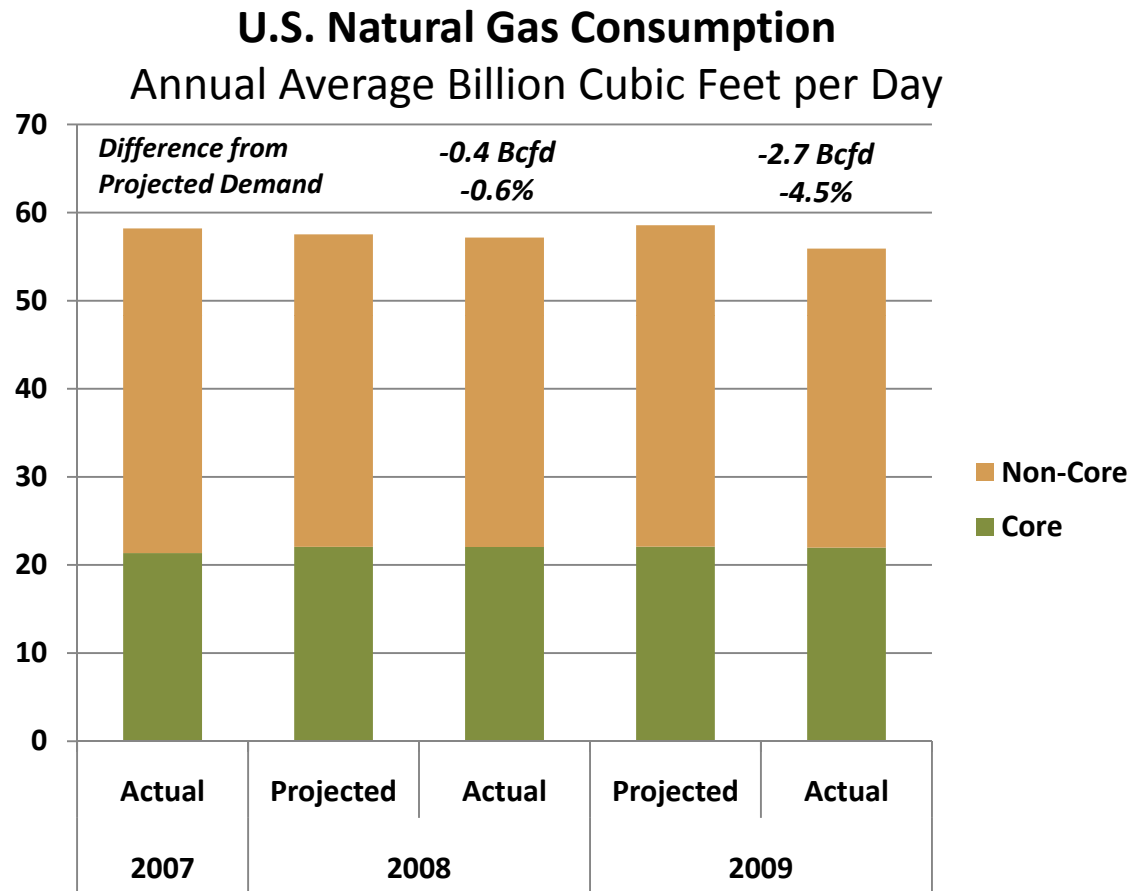


- Review of Recent Trends
- Key Assumptions in ICF's Projection
- ICF's Gas Market Outlook
- Conclusions

The Recession Caused Gas Demand to Decline During the Past Few Years



- Instead of growing modestly from the 2007 level, gas use has declined by about 5 percent, consistent with the decline in economic activity.
- Nearly all of the decline has been in non-core gas use, primarily in the industrial sector.



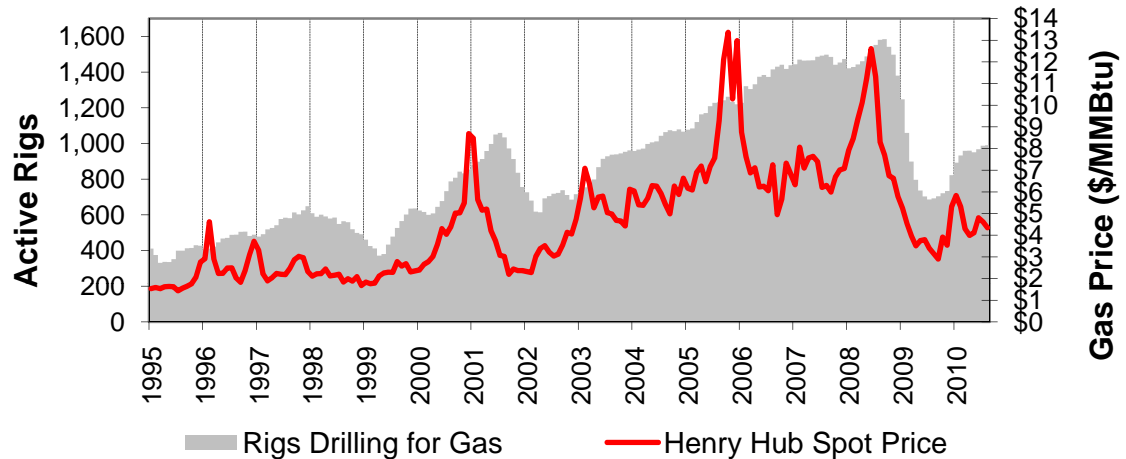
Core demand includes the residential and commercial sectors.
 Non-core demand includes the industrial and power generation sectors.
 Projected values are from ICF's November 2007 gas market projection.

But, the Recession Has Had Less Impact on Gas Supply

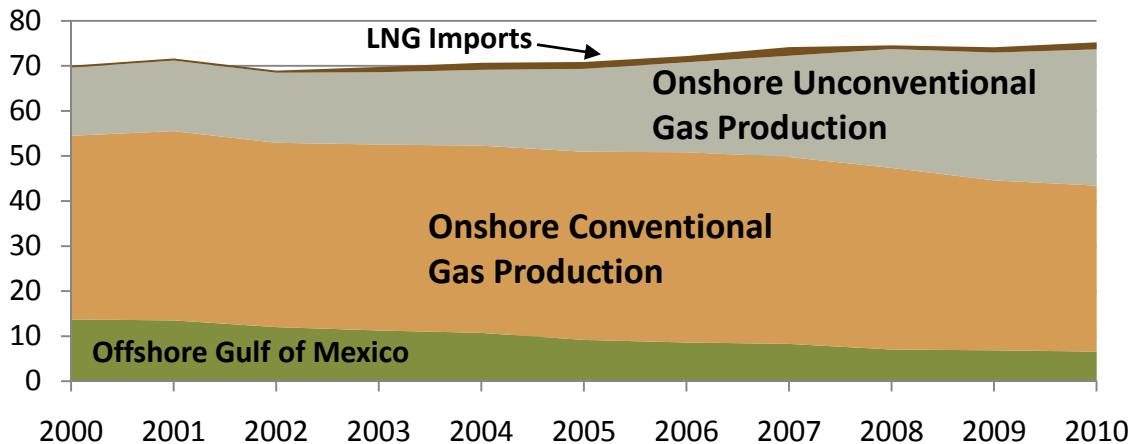


- Drilling activity continued to rise until late 2008 in response to relatively high gas prices.
- A significant decline in activity occurred in late 2008 and early 2009 in response to the collapse in prices.
- Over the past year, activity has rebounded, but the focus is on horizontal wells.
- In the past five years, increases in unconventional gas production have more than made up for the declines in onshore conventional and offshore production.

U.S. Gas Directed Drilling Activity and Gas Prices



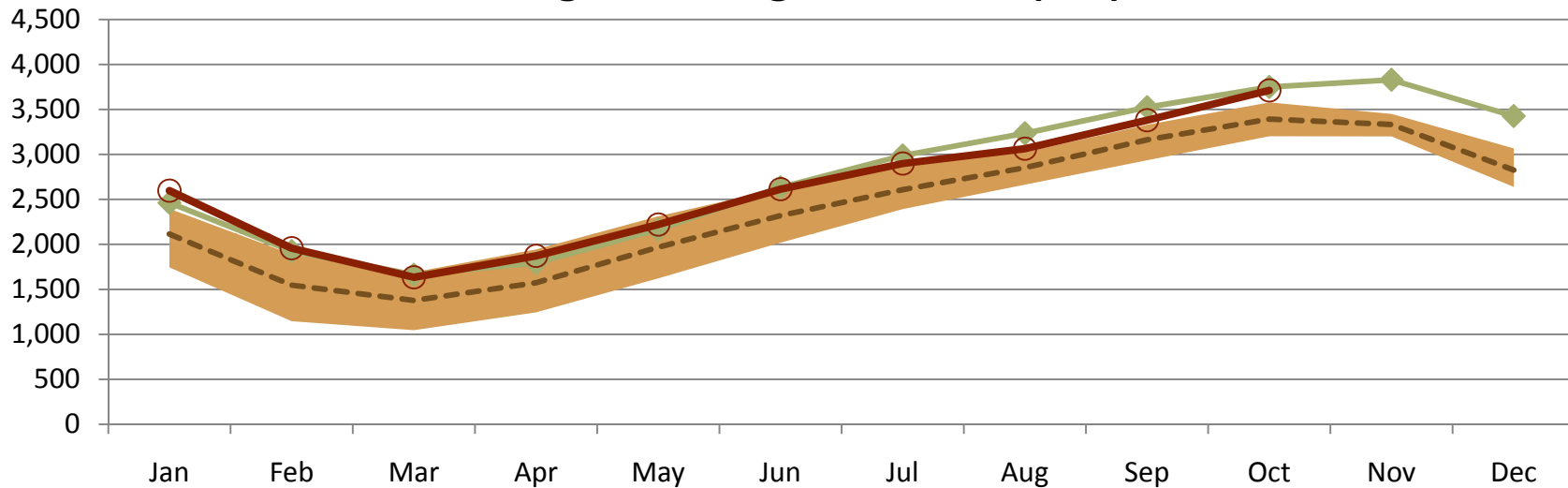
U.S. and Canada Natural Gas Supplies (Average Annual Bcfd)



And, Storage Levels Have Been Relatively High Compared to the Five-Year Average



U.S. Natural Gas Storage Working Gas Levels (Bcf)



Source: EIA

Range, 2004-2008 Average, 2004-2008 2009 2010 (through October)

- Relatively high gas production and weak gas demand, caused by the recession, have led to relatively high natural gas storage inventories, creating downward pressure on natural gas prices.

Natural Gas Prices Reflect the Loose Supply/Demand Balance and Relatively High Working Gas Levels



- Prices during the past year have averaged a little over \$4 per MMBtu, or 50% below the average of \$8 per MMBtu during the prior 5 years.

Monthly Average Gas Prices at Henry Hub
(Nom\$/MMBtu)



Source: Platts

Key Assumptions Behind ICF's Natural Gas Market Projection



- Electricity demand growth is tied to GDP growth.
 - We assume U.S. GDP grows at 2.8% per year, and electricity demand growth averages 1.4% per year.
- Electric generation gas demand is driven by the projections for generating capacity and gas-fired generation from ICF's Integrated Planning Model (IPM).
 - ICF's electric generation and natural gas forecasts both assume a policy limiting CO₂ emissions is in effect after 2018.
 - Power generation is built to satisfy load growth, subject to the costs of each competing technology.
- Demand side management and conservation measures continue to occur, consistent with recent trends.
- Gas supply is developed in ICF's Gas Market Model (GMM) based on the amount of resource available and the E&P finding and development costs associated with the different types of gas resources.
- In the near term, pipeline and storage projects are built based on current plans. In the longer term, projects are added based on economic merit.

The North American Natural Gas Resource Base Could Support Current Levels of Gas Use for Almost 140 Years



- In total, the U.S. and Canada have over 3,700 Tcf of resource that can be economically recovered using current exploration and production (E&P) technologies.
 - At current levels of consumption, this is enough resource for almost 140 years.
 - As technologies improve and new discoveries are made, the total gas resource is likely to grow over time.
- Over 50% of the assumed resource is shale gas.

U.S. and Canada Natural Gas Resource Base

(Tcf of Economically Recoverable Resource, Assuming Current E&P Technologies)

	Proven Reserves	Unproved Plus Discovered Undeveloped	Total Remaining Resource	Shale Resource ¹
Alaska	7.7	153.6	161.3	0
West Coast Onshore	2.3	24.6	27	0.3
Rockies & Great Basin	66.7	388.3	454.9	37.9
West Texas	27.6	47.7	75.3	17.5
Gulf Coast Onshore	70.1	684.7	754.8	476.9
Mid-continent	37	205	241.9	133.9
Eastern Interior ²	18.6	795.7	814.3	728.1
Gulf of Mexico	14	238.6	252.5	0
U.S. Atlantic Offshore	0	32.8	32.8	0
U.S. Pacific Offshore	0.8	31.7	32.5	0
WCSB	60.4	664	724.4	508.8
Arctic Canada	0.4	45	45.4	0
Eastern Canada Onshore	0.4	15.9	16.3	10.3
Eastern Canada Offshore	0.5	71.8	72.3	0
Western British Columbia	0	10.9	10.9	0
US Total	244.8	2602.7	2847.3	1394.6
Canada Total	61.7	807.6	869.3	519.1
US and Canada Total	306.5	3410.3	3716.6	1913.7

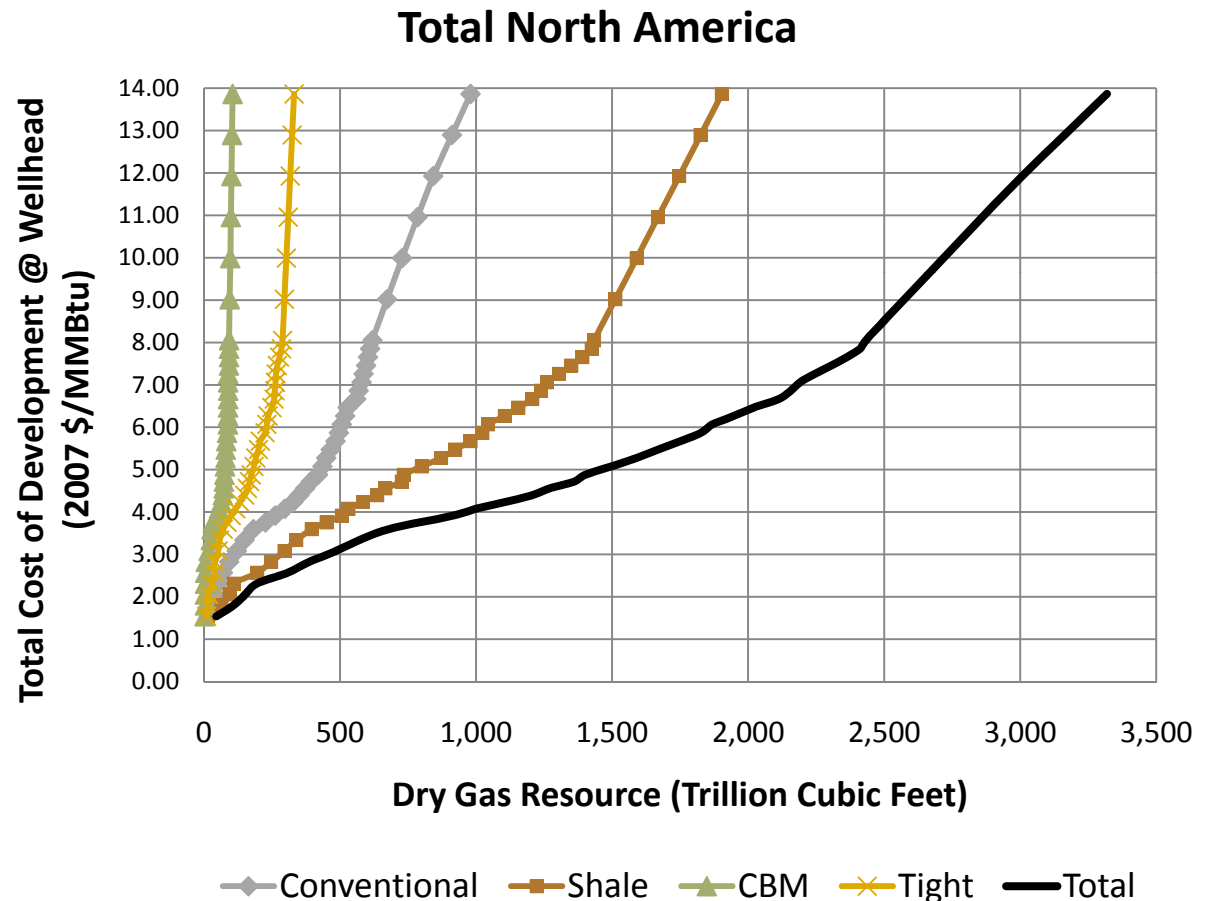
1 . Shale Resource is a subset of Total Remaining Resource

2. Reference case assumes drilling levels are constant at today's level over time, reflecting restricted access to the full resource development.

North American Gas Supply Curves



- The existing North America resource base includes about 1,500 Tcf of gas that is economically recoverable at \$5 per MMBtu.
 - Shale gas accounts for about half of the gas economically recoverable at \$5 per MMBtu.
- Total cost of developing new resource includes exploration, development and O&M costs (both fixed and variable cost).



Even So, the Gas Balance is Likely to Remain Loose Over the Next Several Years



U.S. Natural Gas Supply/Demand Balance

Average Billion Cubic Feet per Day

- Gas demand is likely to turn around and grow, albeit at a relatively modest rate.
 - Most of the rebound in the near-term will occur in the industrial and power sectors, but there are still signs of weakness and much uncertainty.
- Production is likely to continue growing, spurred by growth in shale gas production.

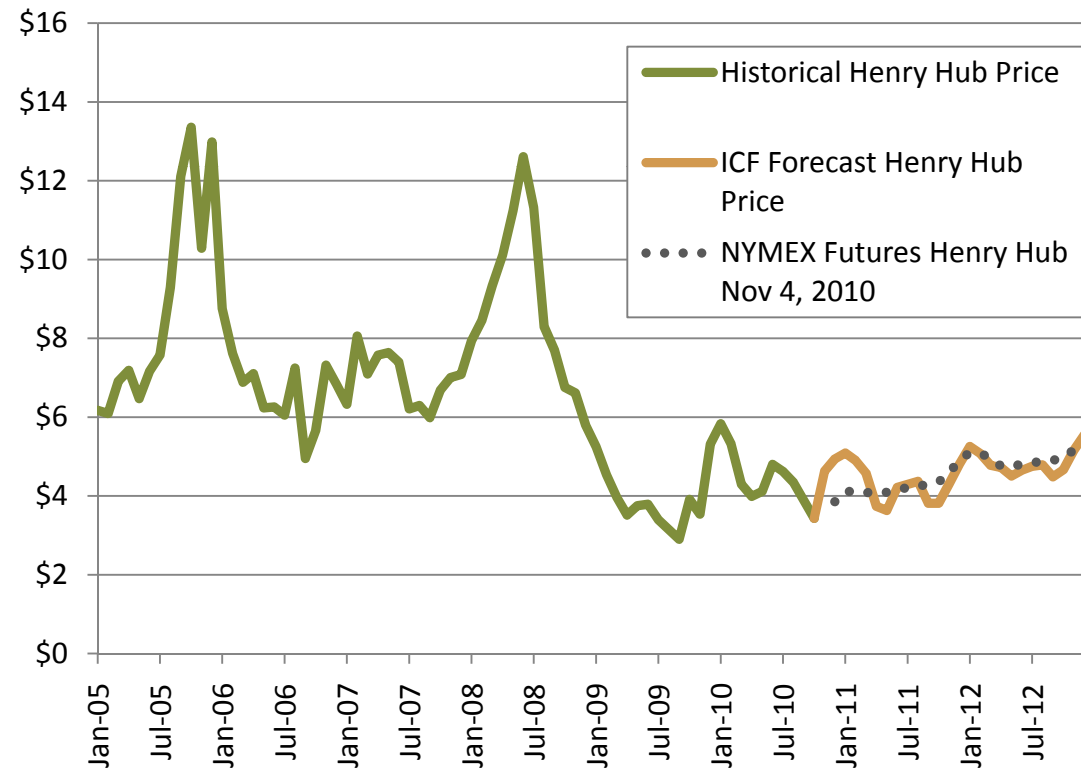
	Injection Season			Withdrawal Season		
	2009	2010	2011	2009/10	2010/11	2011/12
Gas Demand						
R/C/I Gas Use	28.2	28.1	30.4	54.8	55.3	56.5
Power Gas Use	18.6	20.7	19.7	16.1	16.4	16.7
Other Gas Use	5.7	5.7	5.8	5.8	6.1	6.1
Net Injections	10.2	9.8	9.9	0.0	0.0	0.0
Gas Supply						
US Production	56.1	57.3	58.9	55.8	58.9	59.7
Net Imports	7.2	7.8	7.7	7.9	7.8	7.7
Net Withdrawals	0.0	0.0	0.0	14.6	12.2	13.1
Balancing Item (S-D)	0.7	0.8	0.9	1.6	1.1	1.3

Gas Prices are Likely to Rebound Along with the Rebound in Gas Demand



- Gas prices are likely to strengthen somewhat as the economy continues to rebound, but the strength of the rebound will be directly linked to growth in gas use.
- Average level of gas prices over the next year is projected to be near \$4 per MMBtu.
- Our projection runs near the futures market through 2011 and 2012.

Projected Natural Gas Prices Versus NYMEX
Nominal Dollars per MMBtu



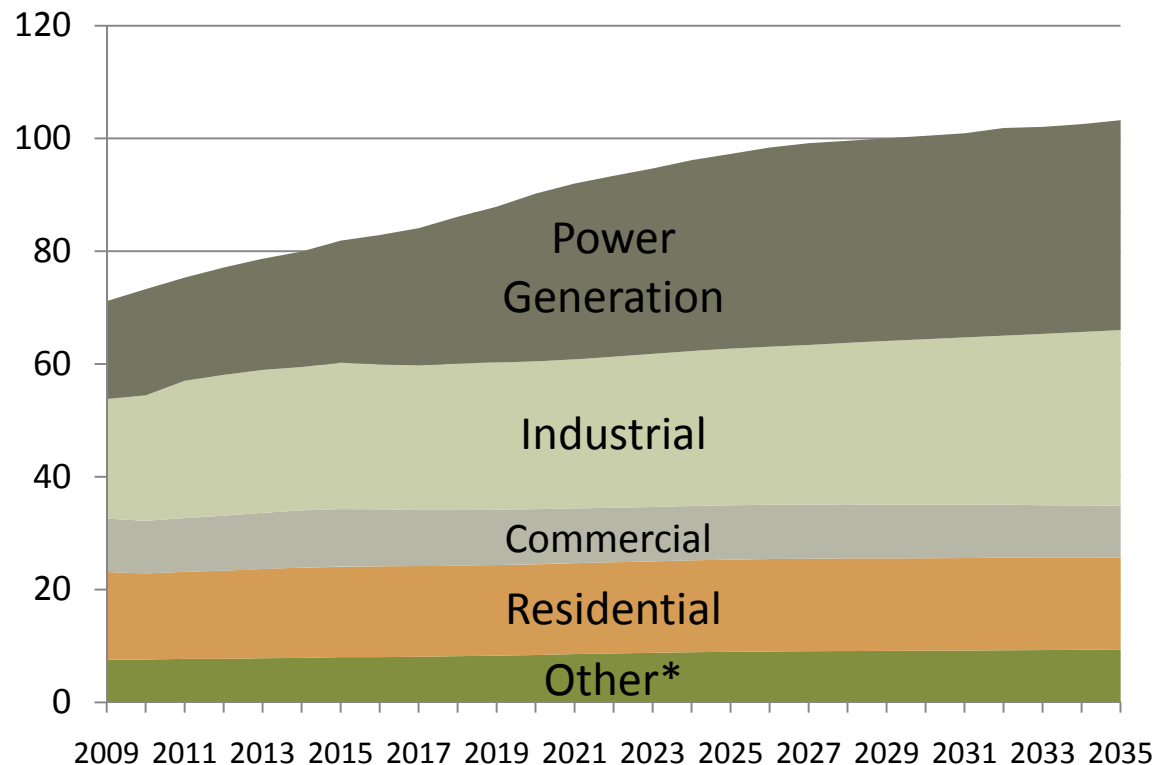
Source: Historical prices from Platts

In the Longer Term, Growth in Gas Consumption Will Continue to be Driven by Growth in Gas Use for Electric Generation



- Gas consumption in the power sector is likely to double over the next 20 years.
 - By 2035, total gas consumption in the U.S. and Canada is projected to reach an average of 103 Bcf per day.
- Very little demand growth occurs in the other sectors.

U.S. and Canadian Gas Demand (Average Annual Bcfd)

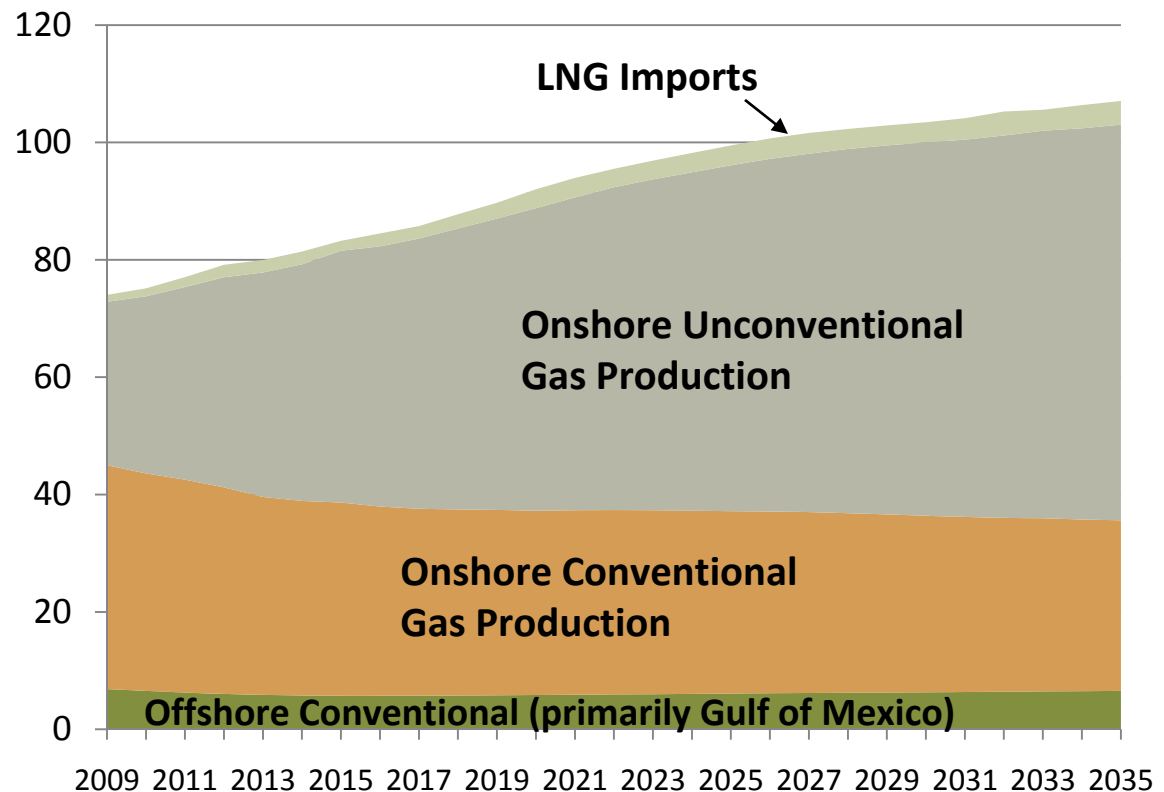


Future Supply Growth Continues to Depend on Unconventional Gas Supplies



- Onshore conventional and offshore gas production continues to decline, while unconventional production grows robustly.
- Onshore unconventional gas production grows from about 40 percent of total gas supply in 2009 to upwards of 60 percent in 2035.

U.S. and Canadian Natural Gas Supplies (Average Annual Bcfd)

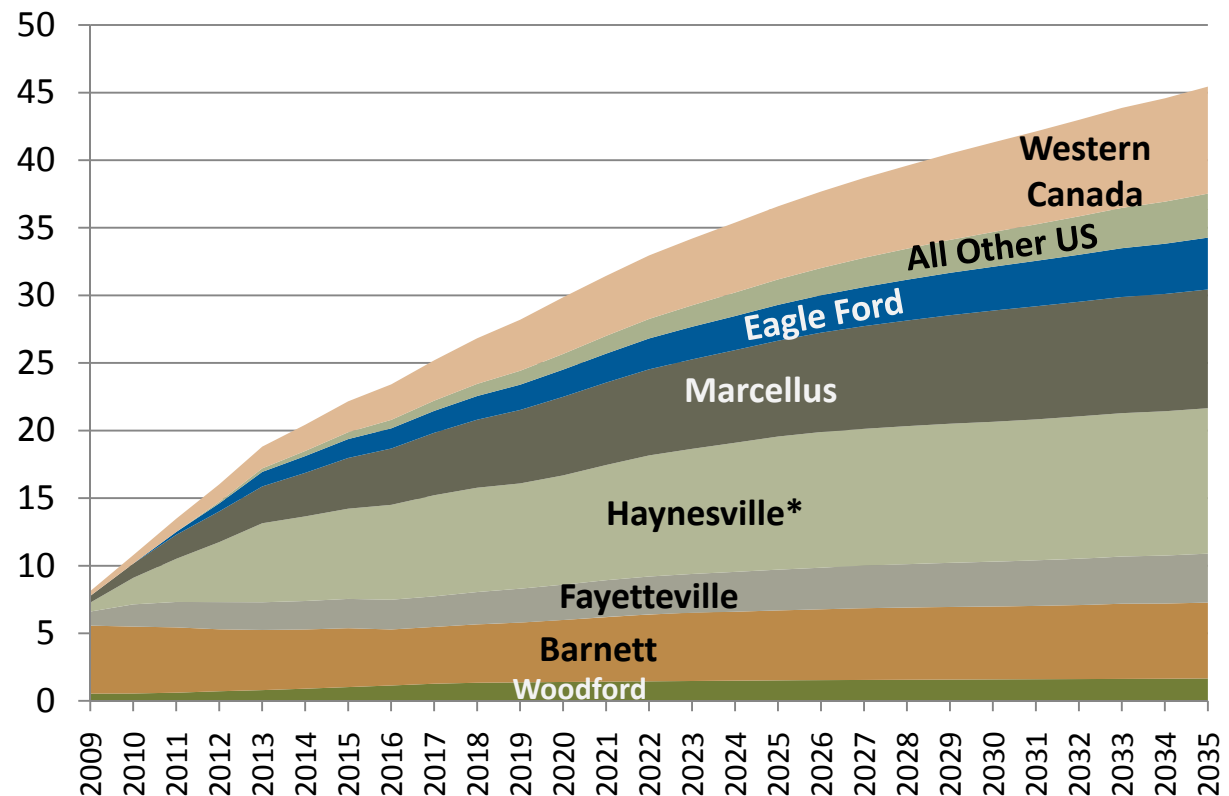


Shale Gas is a “Game Changer” for North American Gas Markets, Providing Most of the Supply Growth Over the Next Ten Years



- The shale gas plays are among the fastest growing production areas worldwide.
- Total U.S. and Canada shale gas production is expected to increase from about 8 Bcfd in 2009 to 45 Bcfd by 2035.
- Barnett has been under development for almost 10 years, while development of Eagle Ford began in 2009.
- The strength of the shale plays was evident during the recession, when development continued despite relatively low natural gas prices.
- However, concerns over water use and disposal of fracturing fluids could limit the pace of future development.

U.S. and Canadian Shale Gas Production (Average Annual Bcfd)



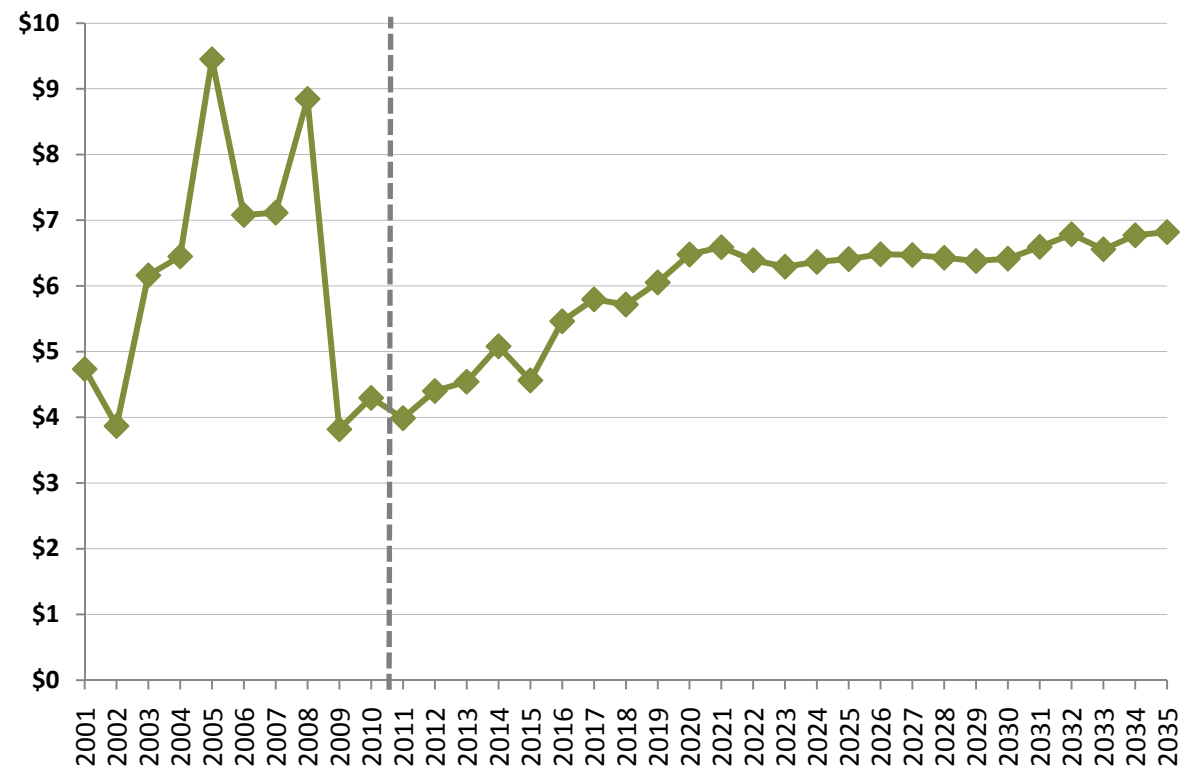
*Haynesville values shown here include production from other shales in the vicinity, e.g., the Bossier Shale.

Henry Hub Gas Prices Will Average Between \$5 and \$7 per MMBtu



- Henry Hub natural gas prices are projected to average between \$5 and \$7 per MMBtu.
- Robust growth in gas demand applies upward pressure on gas prices over time.
- \$5 to \$7 gas prices are sufficient to support the levels of supply growth in the projection, but not so high as to discourage market growth.

Average Annual Natural Gas Prices at Henry Hub (2008\$/MMBtu)



Basis Trends are Influenced by Regional Supply and Demand Shifts, but Also Reflect Added Gas Infrastructure



Average Basis (2008\$/MMBtu)

- Projected regional basis values for a number of areas are consistent with or below levels observed during the past 10 years.

	2001 to 2009	2010 to 2020	2021 to 2035
Henry Hub to NYC	1.05	0.95	0.98
Henry Hub to Dominion North Point	0.44	0.30	0.30
Henry Hub to Dominion South Point	0.41	0.27	0.26
Henry Hub to Chicago	-0.07	0.10	0.13
Henry Hub to Dawn	0.19	0.50	0.51
Henry Hub to South Florida	0.57	0.48	0.51
AECO to Chicago	0.85	0.63	0.51
Opal vs Henry Hub	1.49	0.53	0.63
Opal to Dominion North Point	1.93	0.83	0.93
Opal to Dominion South Point	1.89	0.80	0.89
Opal to Southern California	1.45	0.32	0.44
Southern California vs Henry Hub	0.04	0.21	0.18
Mid-continent vs Henry Hub	0.68	0.23	0.25
East Texas vs Henry Hub	0.25	0.07	0.10
San Juan Basin vs Henry Hub	1.10	0.43	0.46

Sources: Platts Gas Daily (historical), ICF International (projection)

Gas Markets will Likely Grow Robustly as Unconventional Gas Supplies Continue to Grow



- Total gas consumption will grow at an average of 1.4 percent per year over the next 25 years, driven almost entirely by growth in gas-fired power generation.
 - Increased efficiency, conservation, and GHG regulations are uncertainties that will have an impact on future growth in gas use.
- Production of shale gas reserves, where a significant portion of remaining gas resources are located, should contribute to a robust increase North American supplies.
 - Concerns over water use and disposal of fracturing fluids could adversely impact the pace of shale gas development.
 - Exploration and production in the Deep Water Gulf of Mexico also may be limited due to environmental concerns.
- Regional shifts in gas supply and demand will drive future gas infrastructure needs.
 - Construction of new pipeline capacity is likely to continue at a rapid pace over the next 5 to 10 years.

Natural Gas Prices are Likely to Average Between \$5 and \$7 per MMBtu



- Projected Henry Hub gas prices are likely to average between \$5 and \$7 per MMBtu Through 2035.
 - Prices will be high enough to support the robust supply development projected over time, but not so high as to adversely impact market growth.
- Significant short-term gas price volatility is likely to continue.
 - Abnormal weather events and rapid shifts in economic activity can significantly change gas prices over relatively short periods of time.
 - But, market forces will tend to push gas prices back into the \$5.00 to \$7.00 per MMBtu price range.



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