

Natural Gas Abundance: *Turning the North American Energy Market on its Head!*

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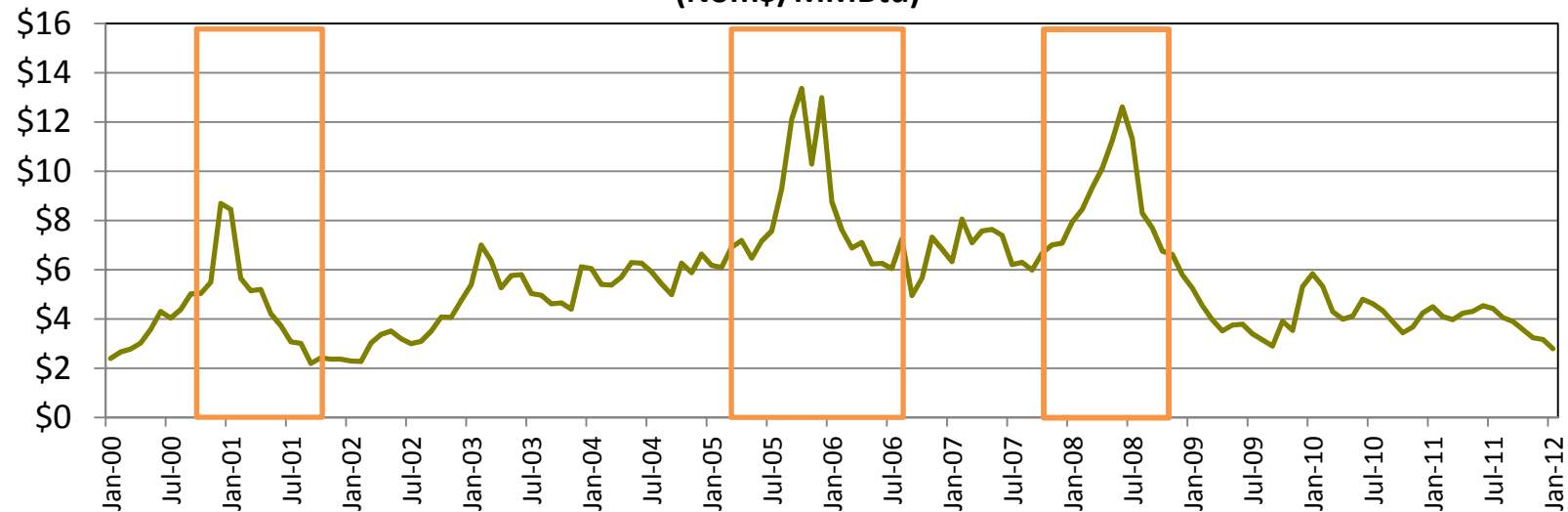


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Historical Natural Gas Prices



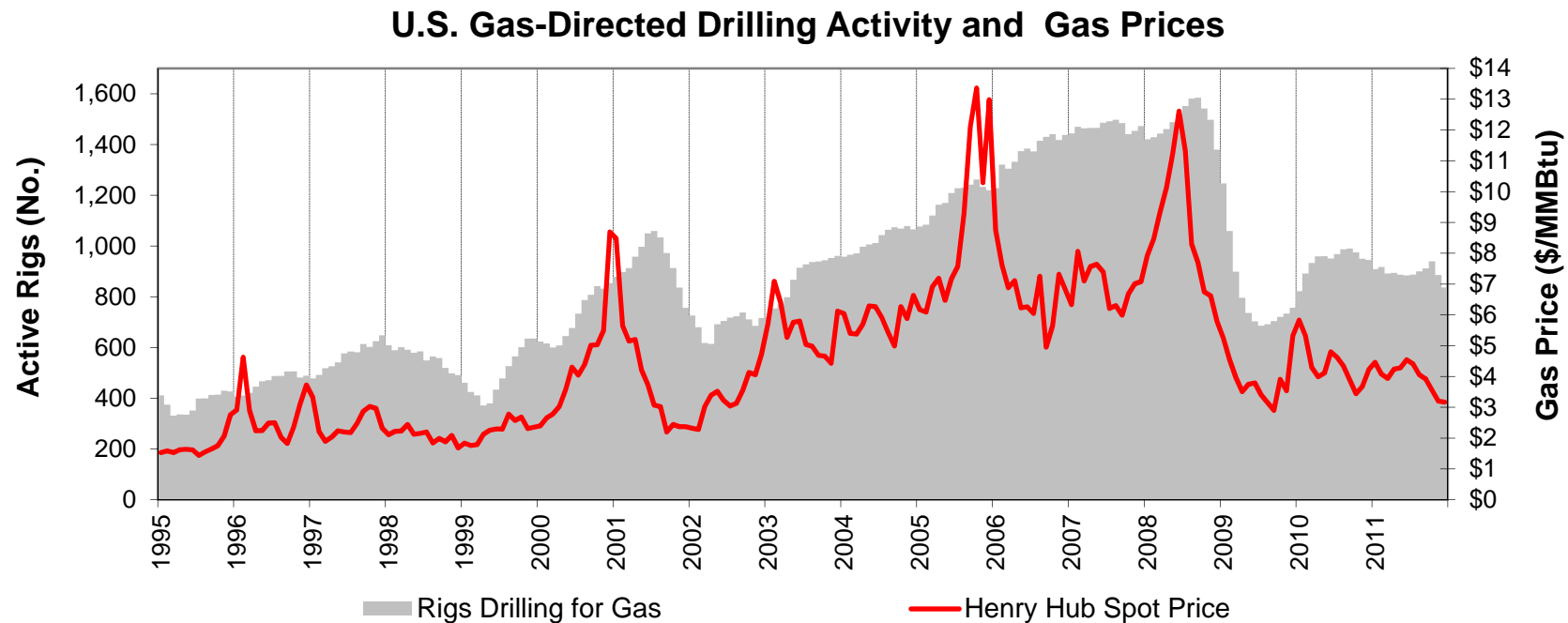
**Monthly Average Gas Prices at Henry Hub
(Nom\$/MMBtu)**



Source: Platts

- In the last decade, there have been three periods where natural gas prices have spiked.
- Each of these periods had a different driver for the increase in prices.
- Recently, prices have collapsed.

Gas Drilling Response to Price Movements



- In response to each of the three previous price spikes, drilling levels increased. The resulting increase in supply moderated prices.
- In the most recent period, gas supplies have been increasing significantly even though rig activity is nowhere near peak levels.

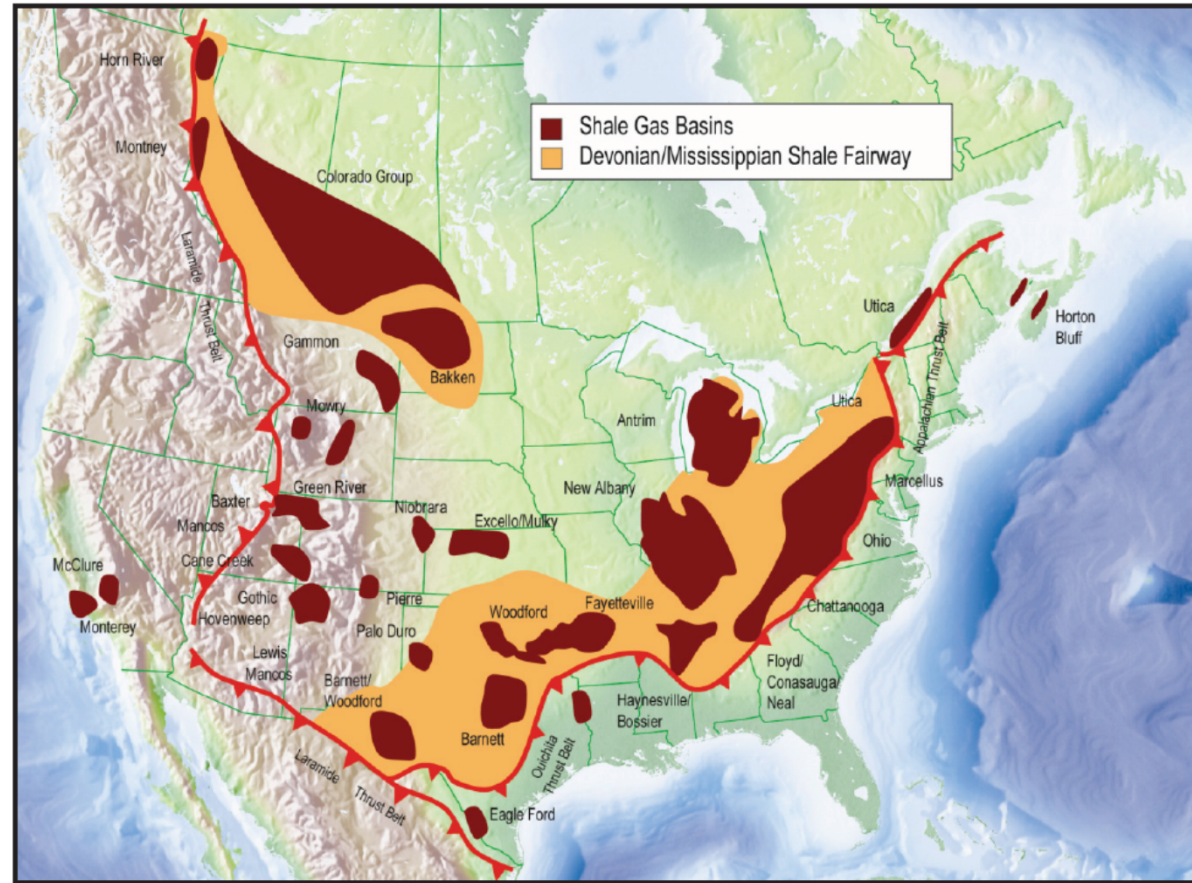
The Opportunity!

Shale and Other Unconventional Resource

Shale Formations of the U.S. and Canada



- Shale formations are widely distributed.
- Liquids content vary by location, which affects the economics of development.



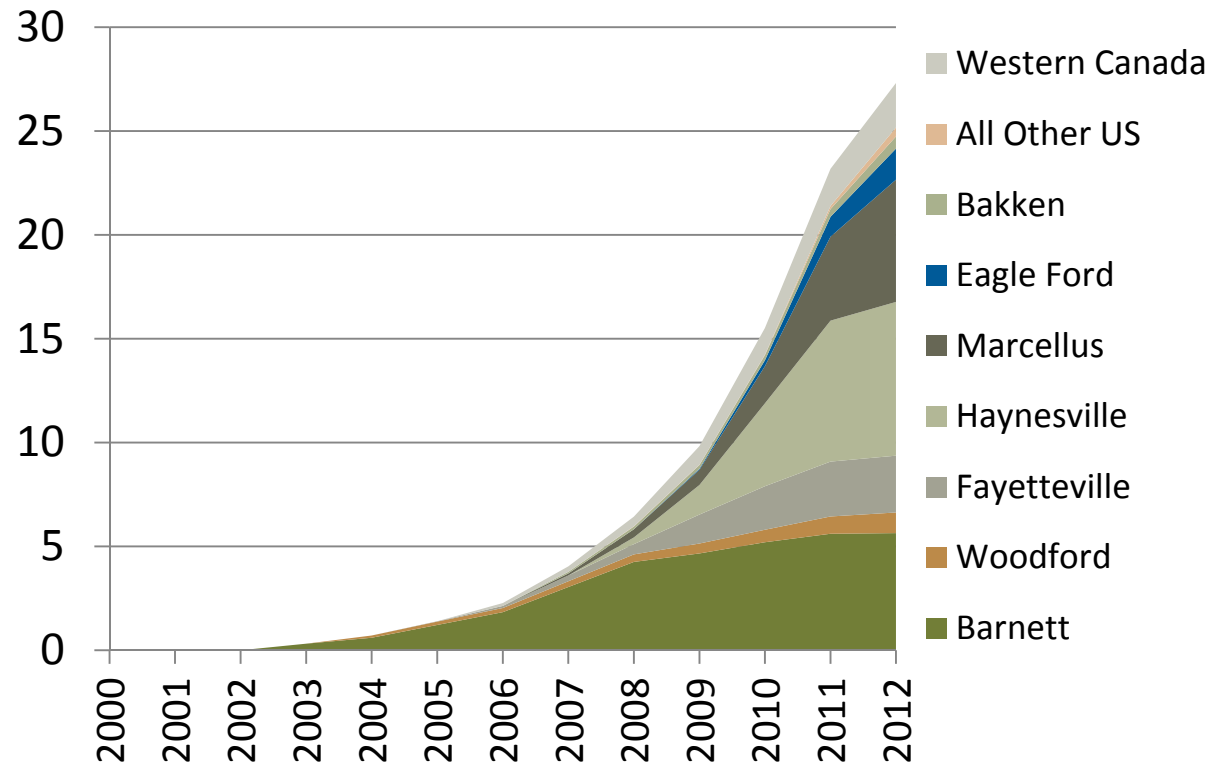
Source: NEB, "Understanding Canadian Shale Gas," 2009

Slower Gas Production Growth Expected in 2013 as Drilling Declines Impact Many Shale Plays



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

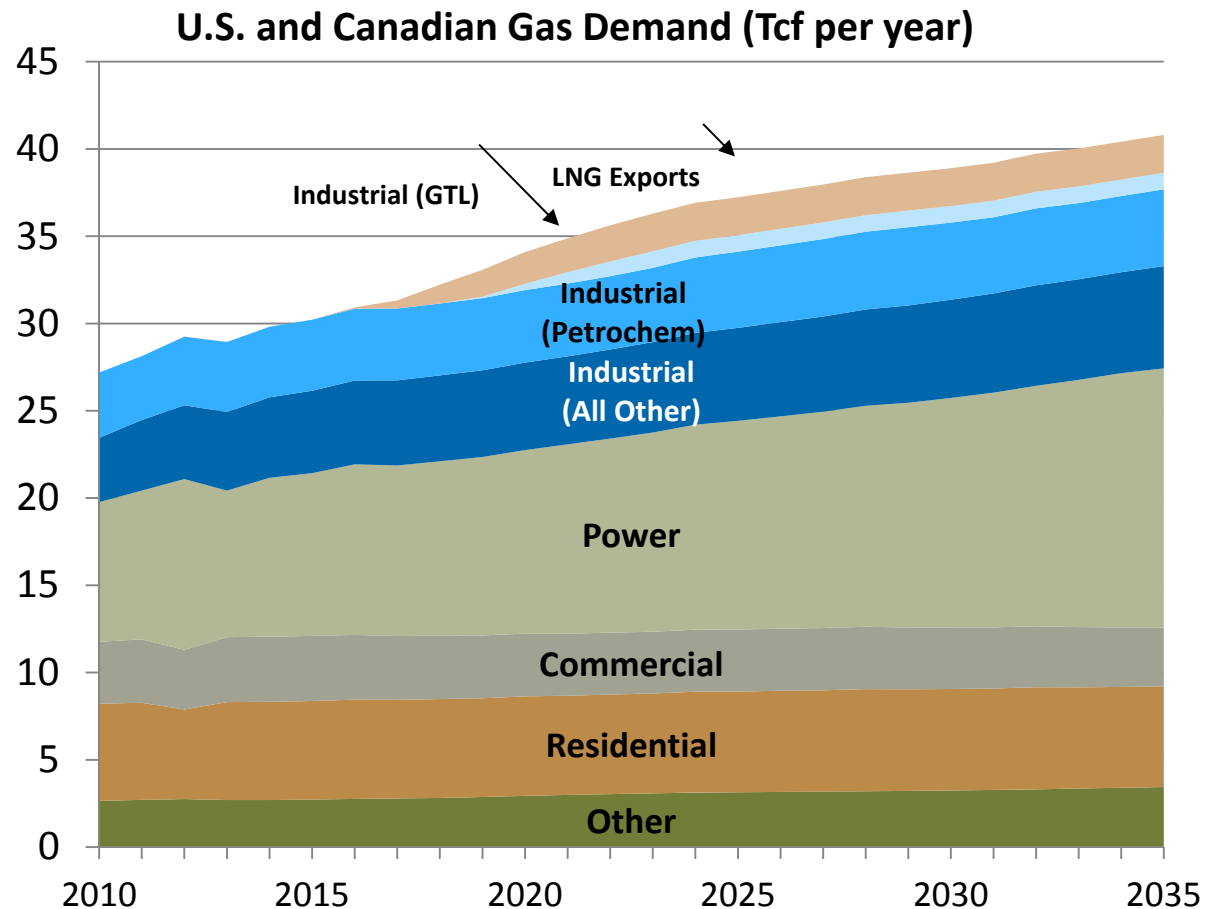
- Since 2005, shale gas production has increased roughly 40% per year, while 2012 is projected to grow by a more modest 20%, relative to 2011 levels.
- Liquids-rich plays, like Eagle Ford, are expected to grow at a faster pace, while growth in dry gas plays is slowing (except for in the Marcellus).



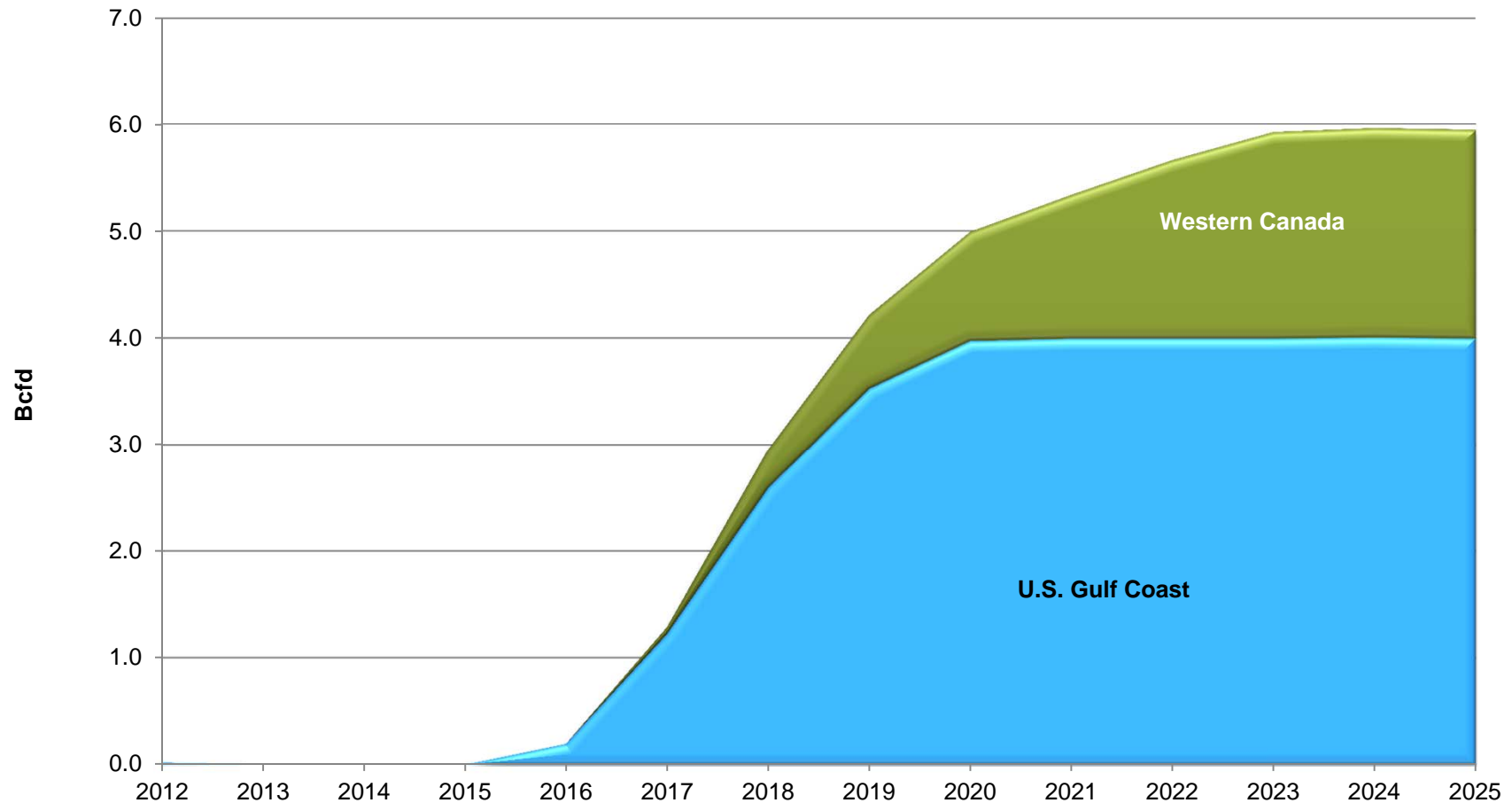
Gas-Fired Power Generation Growth will Continue to Drive Gas Consumption Growth



- Total gas demand is projected to increase at a rate of 1.5% per year.
 - Power sector gas use will continue to grow.
 - New gas-to-liquids (GTL) plants are expected to add nearly 1 Tcf of demand.
 - LNG exports expected to total 6 Bcfd (2 Bcfd from Canada and 4 Bcfd from the Gulf Coast).
- Not much growth in the residential and commercial sectors, but oil-to-gas conversions are likely to spur some regional growth.



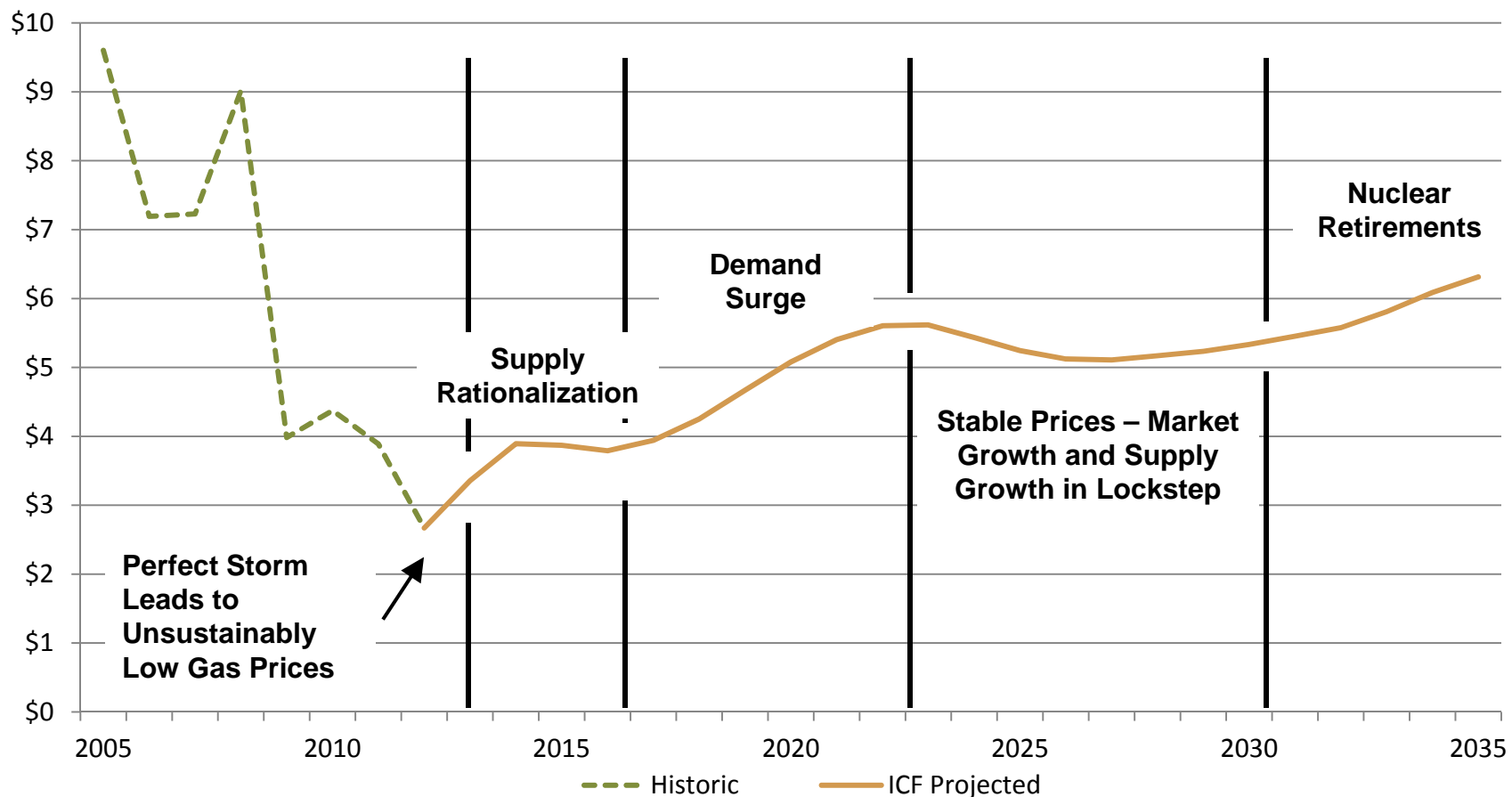
Projected North American LNG Exports (Bcfd)



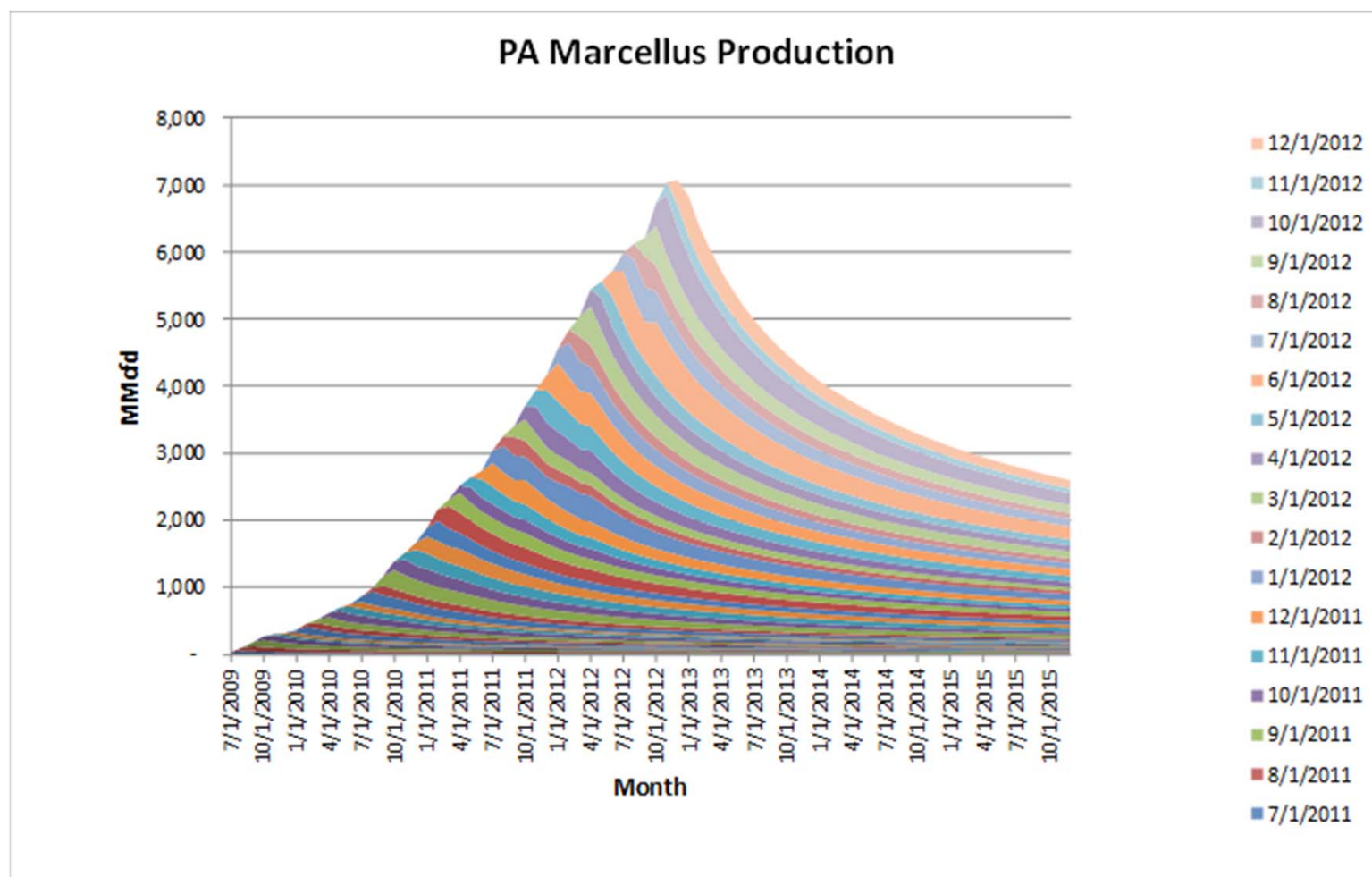
Gas Prices Remain Relatively Low in the Near Term, but then Increase as the Market Grows



Annual Average Gas Prices at Henry Hub (2010\$/MMBtu)



Production in the Marcellus Continued to Grow Despite Low Price

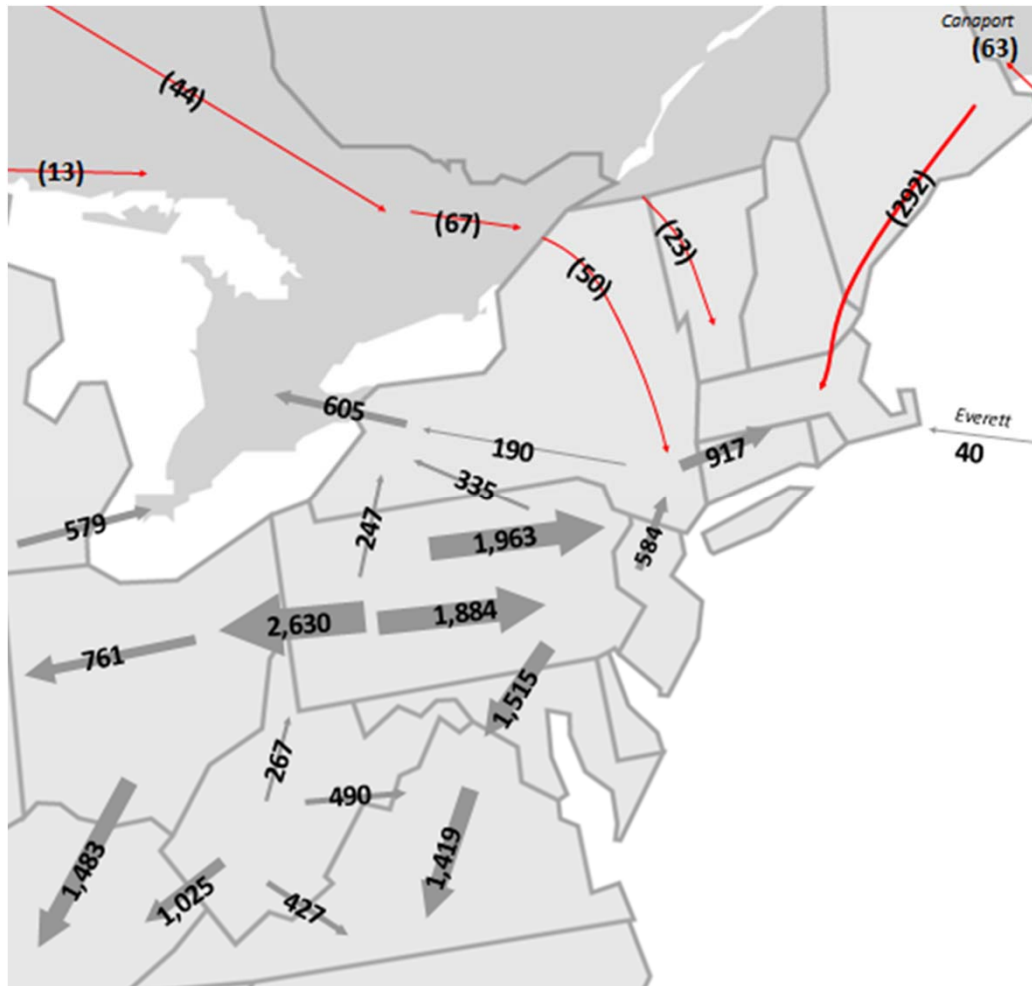




***Abundance is a Good Problem to have, but
still can Create Challenges!***

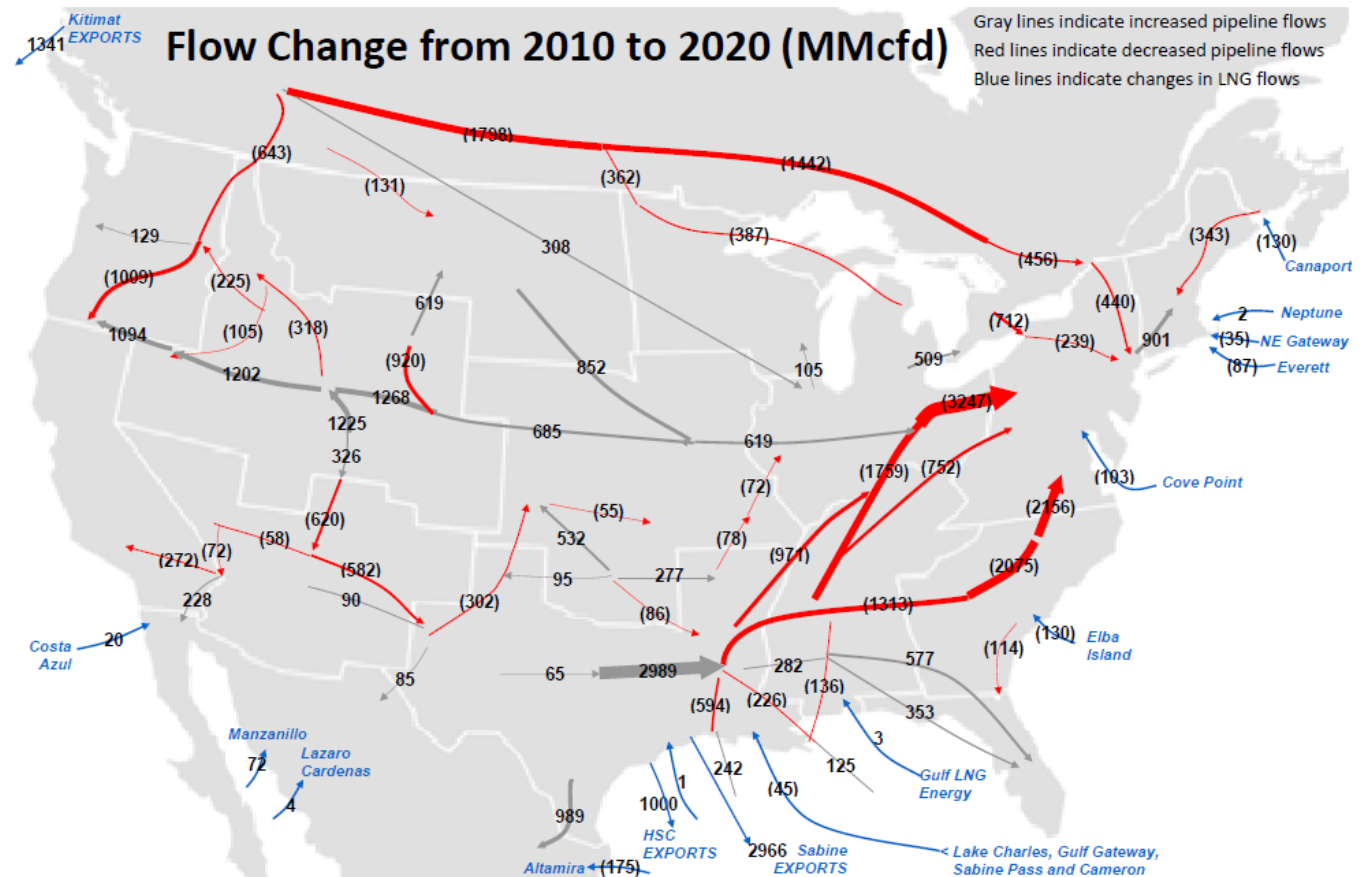
Impact of Marcellus Production Growth on Regional Flows (2012-2025)

Change in Average Annual Flows (MMcfd)



Supply and Demand Changes will Significantly Change Pipeline Flows Over the Next 10 Years

- Increases in flows from the Gulf Coast to the east are due to increases in Mid-continent shale gas production.
- Modest increases in the Rockies both east and west.
- Marcellus gas production growth displaces gas flows into the U.S. Northeast (shifts within the Northeast are not depicted on this interregional flow map).
- Declining conventional production in Alberta and increasing gas consumption for oil sands development causes flows from western Canada to decline.



Challenge #1

Basis Compression

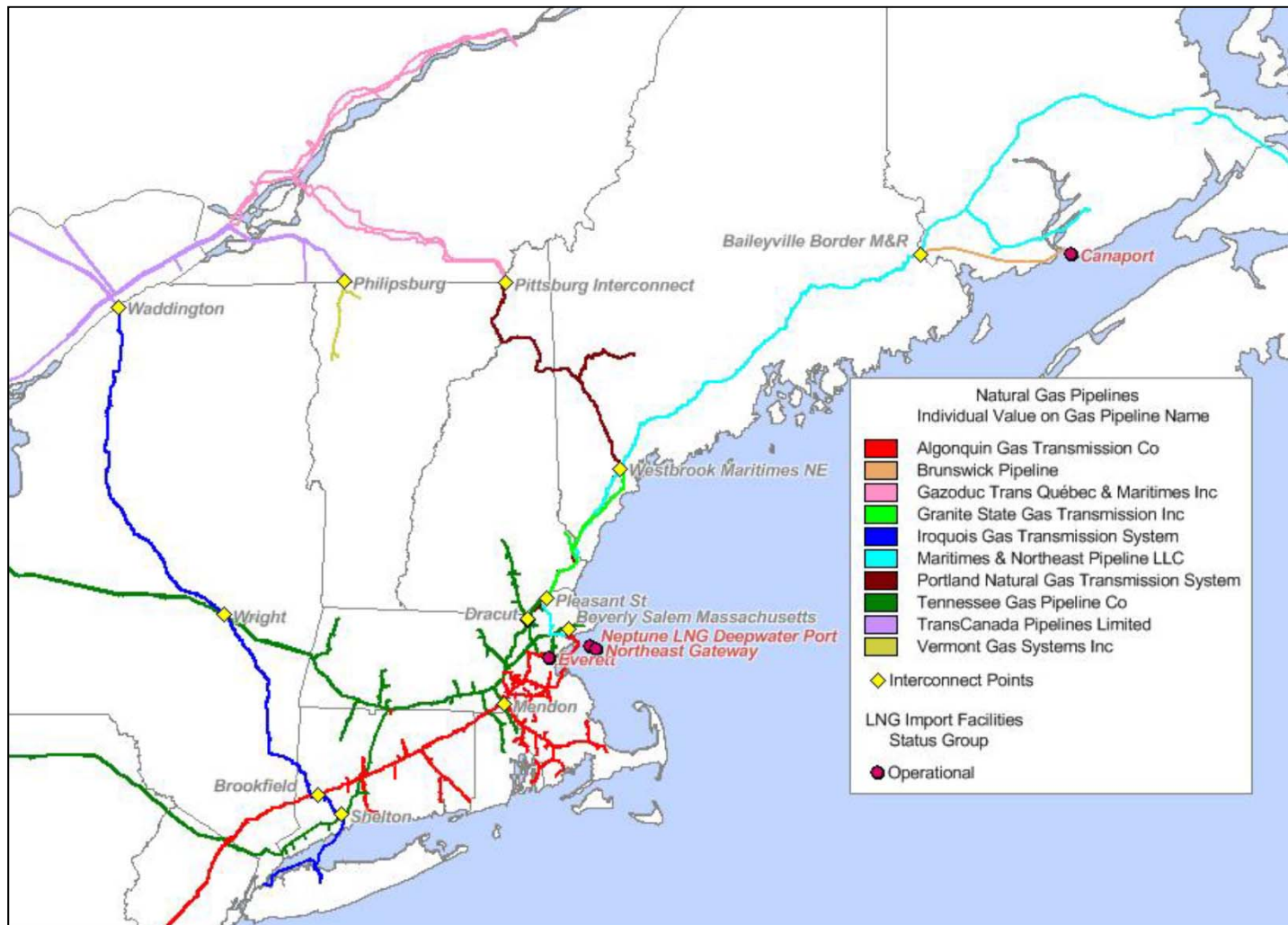


- Basis is the difference between gas prices at two locations where liquid gas trading occurs.
- Basis provides a measure of the value of gas transportation capacity between those locations with liquid trading.
- The Challenge – For many transportation paths, the average annual basis values are less than the cost of building new pipeline capacity.

***An exception is New England.
But New England presents a Different Challenge***

Challenge 2

Natural Gas Delivery into New England



New England Pipeline Capability



- Six (6) interstate pipelines serve New England's gas consumers

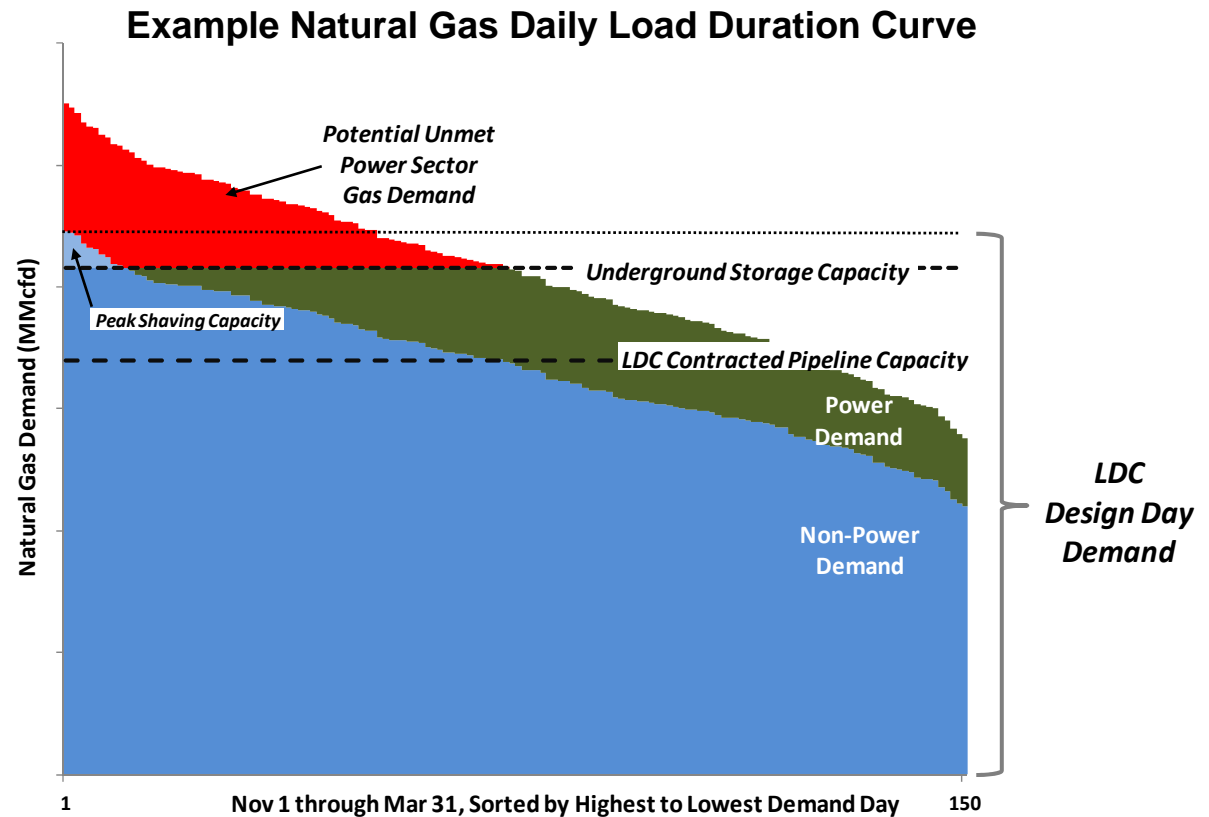
		Winter 2011/12
<u>Pipeline System</u>		<u>Contract Capacity (MMcf/d)</u>
1.	Algonquin Gas Transmission (AGT)	1,087
2.	Iroquois Gas Transmission (IGT)	220
3.	Maritimes and Northeast Pipeline (M&N)	833
4.	Tennessee Gas Pipeline (TGP)	1,261
5.	Portland Natural Gas Transmission (PNGTS)	168
6.	Granite State Gas Transmission (GSGT)	119

- With the exception of Granite State, all these pipelines provide transport from outside of New England into the region.
 - Granite State receives all of its gas from within New England, and therefore is not counted toward the region's in-bound gas pipeline capability.
- Flows on the M&N Pipeline are partially dependant on imports into the Canaport LNG import facility.

Analytics of Pipeline Capacity Adequacy



- Where LDCs hold nearly all pipeline capacity, power generator access depends on time of year and weather.
- Analysis of resource adequacy requires the ability to project available gas capacity as a function of economic/load growth and weather for non-power sectors.
- Must also be able to assess the interactions with regions upstream and downstream of the target region.



Operational Issues



- Daily operations
 - Gas day versus electric day
 - Nominations and confirmation processes
 - Information exchanges
 - Intraday adjustments to market conditions
- Emergency procedures
 - Declaration of emergencies
 - Notification processes to stakeholder
 - Communications protocols and legal protections
 - Contract rights and curtailment priorities
 - Coordinated restoration processes
- Coordinated planning and scheduled outages
 - Data needed for long-run resource adequacy assessments
 - Coordinated scheduled outages with gas industry and between gas and electric industries

Policy Issues



- What will be the infrastructure changes needed in the future to assure reliable electric service in the U.S.?
- Can current practices, policies, and regulatory structures identify and produce the desired infrastructure outcome?
- How should one ideally look at the question of "social optimum" reliability across both electric and fuel supply systems? Where are the costs and benefits located?
- What are the implications for natural gas availability measurements and standards and how should one approach issues of gas market regulation and cost recovery?
- What options exist to change market designs, regulations, and standards to achieve a better outcome for electric system reliability? What role would each institution play? What information would be needed to do this effectively?

Challenge 3

Infrastructure Development must address Gas Markets and Liquid Markets



	Total Gas	Crude and Cond.
	Tcf	Bn Bbls
Lower 48		
Proved reserves	263	19
Reserve appreciation and low Btu	219	23
Enhanced oil recov.	0	42
New fields	488	68
Shale gas and condensate	1,964	31
Tight oil	88	25
Tight gas	438	4
Coalbed methane	66	0
Lower 48 Total	3,526	212
Canada		
Proved reserves	61	4.3
Reserve appreciation	29	3.0
Stranded frontier	39	0.0
Enhanced oil recov.	0	3.0
New fields	219	12.0
Shale gas and condensate	601	0.3
Tight oil	108	12.1
Tight gas (with conv.)	0	0.0
Coalbed methane	76	0.0
Canada Total	1,133	35
North America Total	4,659	247

- Liquids value are important parts of the development of the North American resource.
- Liquids values can be “bottlenecked” by infrastructure constraints.
- To develop gas to put into pipeline projects requires the development of infrastructure for both markets.

Acceptance of Energy Exports and Energy Trade



- The political debate has centered on LNG exports and the TCPL Keystone XL pipeline.
 - TCPL Keystone XL has been a “poster” environmental issue.
 - But the issues are much broader.
- Gas developed to support LNG exports would be accompanied by significant liquids production, which could be used domestically or exported.

Conclusion



- Abundant supply is a real benefit to the gas consumers and the industry.
 - Gas supply will likely remain sufficient for 150 years.
 - But that does not mean that prices will not fluctuate from year to year.
- Shifting locations in gas supply are causing “basis compression” in many regions.
 - New pipeline capacity adds to basis compression
- Developing pipeline infrastructure projects is difficult, in part due to basis compression.

Who will sign up for new firm capacity?