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THE UNIVERSITY OF TEXAS AT AUSTIN



Major Challenges for Gas: What Can be Expected for Mexico?

Gas Future Forum, Mexico, April 3, 2014

Overall Observations

- **Resources ≠ Reserves ≠ Deliverability**
  - Deliverability is key
- "Sweet spot" geology
  - Shale "silos" – portfolio repositioning underway
- Liquids are critical to well economics
  - Implications outside of U.S./Canada?
- U.S. demand build-out is real
  - Midstream, logistics challenges for both oil, gas
- Exports
  - Desperately seeking expectations management
- Industry brand
  - Managing SSHE risk

Capital provider priorities

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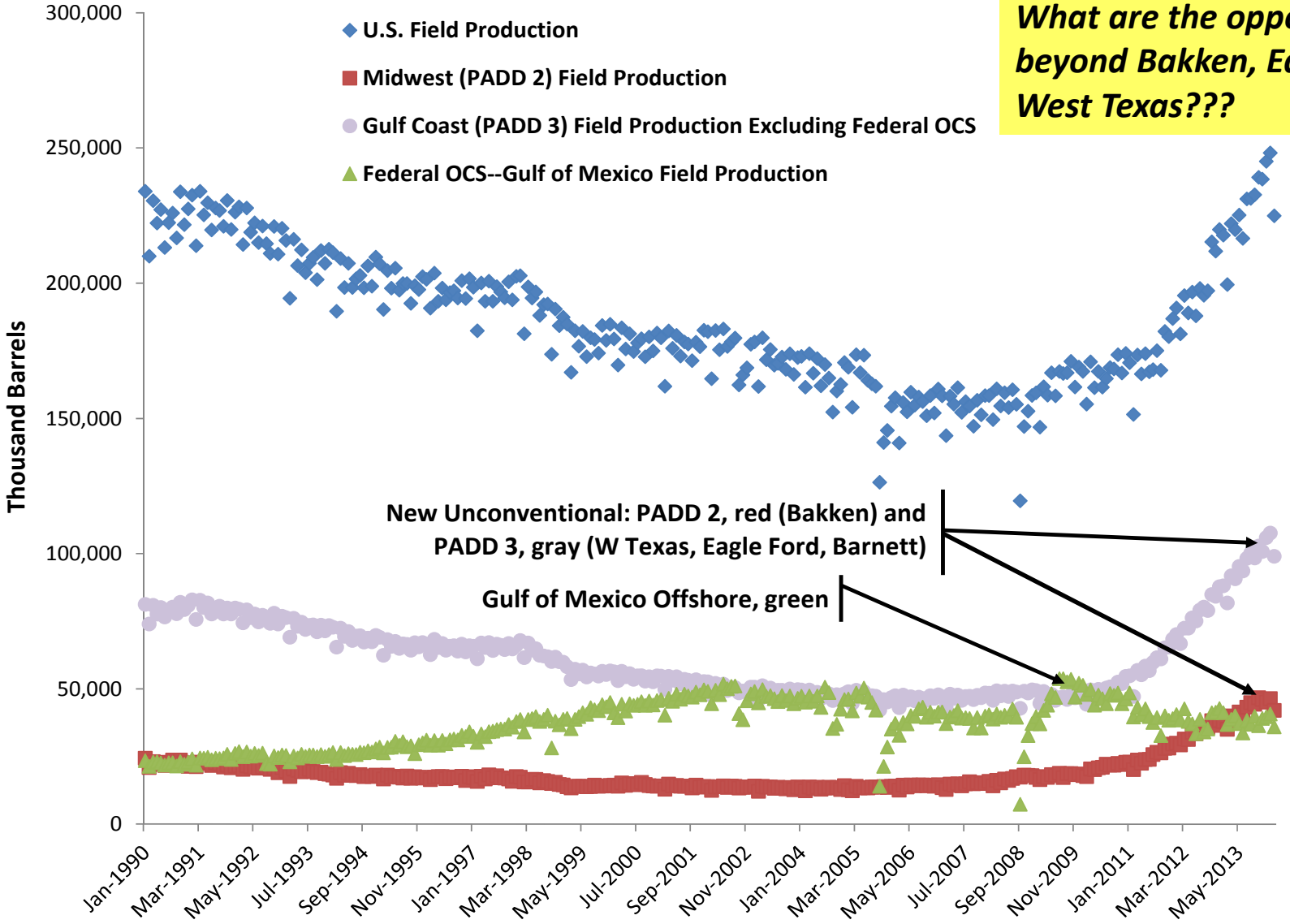
U.S. Crude Oil Production



What are the opportunities beyond Bakken, Eagle Ford, West Texas???

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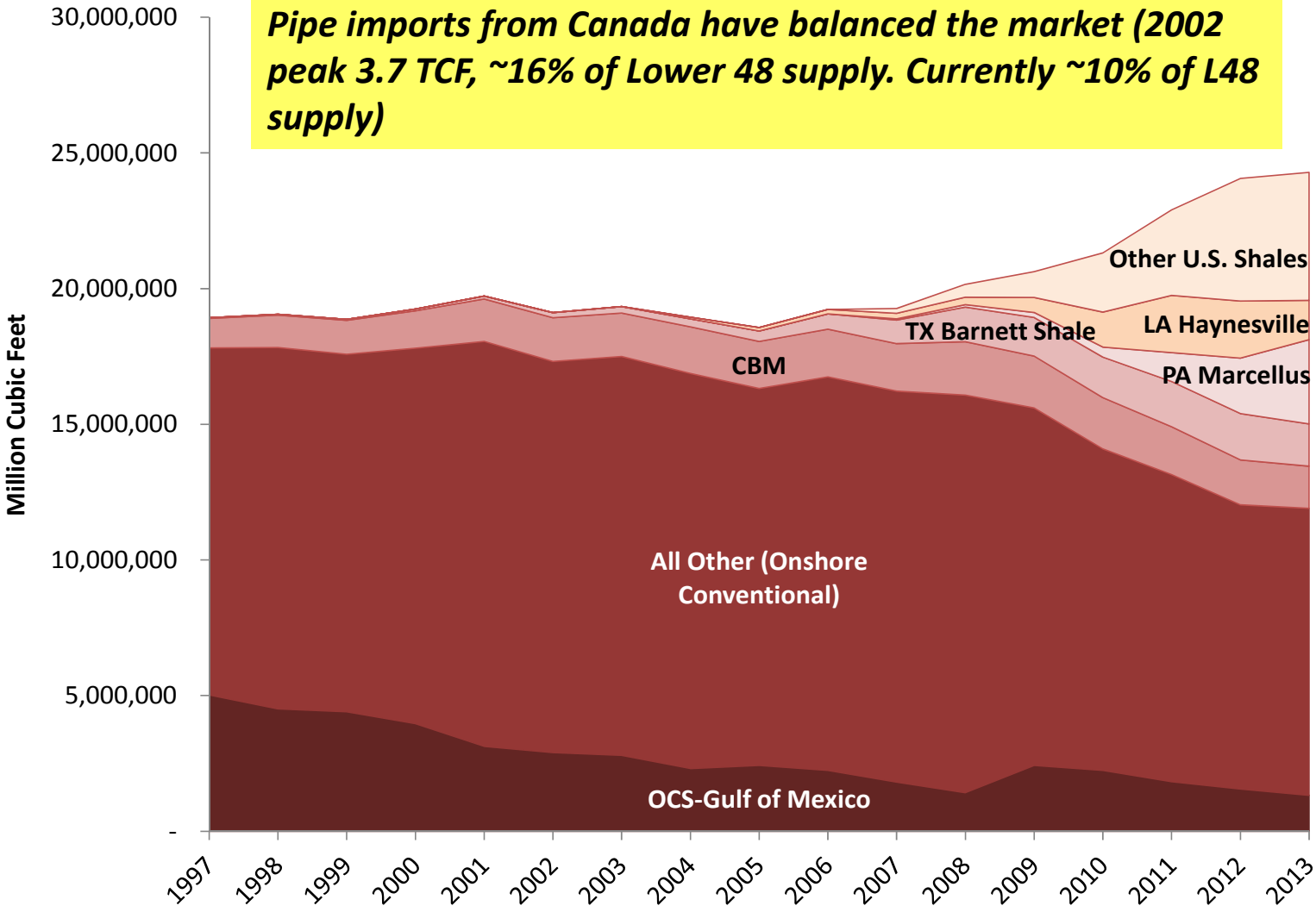
CEE analysis based on EIA

U.S. Dry Gas Production by Type

Pipe imports from Canada have balanced the market (2002 peak 3.7 TCF, ~16% of Lower 48 supply. Currently ~10% of L48 supply)



* 2012-2013 estimates for other shales, CBM based on industry and state government data

CEE analysis based on EIA, state government reporting

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Dry Gas Production Growth Trends

Slower growth with falling NG price and other constraints

	2009-2010	2010-2011	2011-2012	2012-2013
U.S. Total Dry Natural Gas Production	3%	7%	5%	1%
Other U.S. Shales	129%	45%	43%	*4%
LA Haynesville	133%	63%	0%	*-31%
PA Marcellus + Other	100%	189%	92%	*52%
TX Barnett Shale	5%	11%	2%	-9%
CBM	-1%	-7%	-6%	*-6%
All Other (Onshore Conventional)	-10%	-5%	-7%	*1%
OCS-Gulf of Mexico	-8%	-18%	-15%	-15%

"" indicates CEE estimates based on state government and industry information.*

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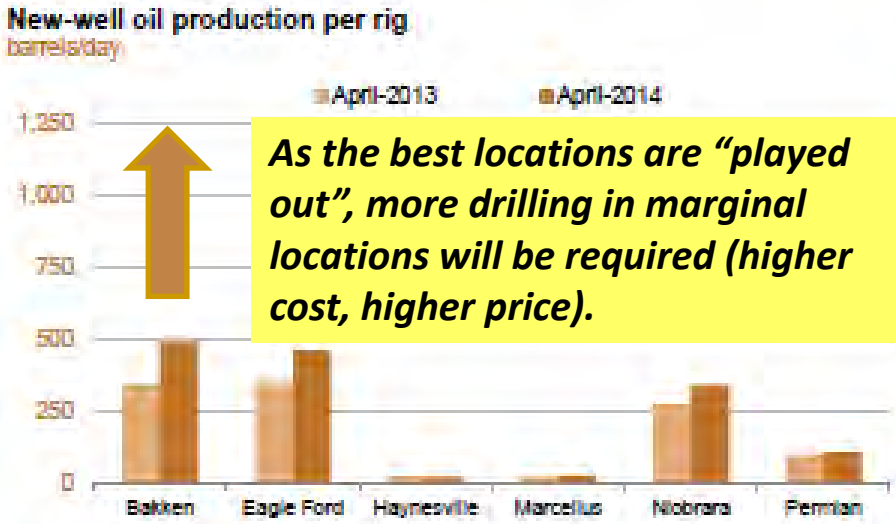
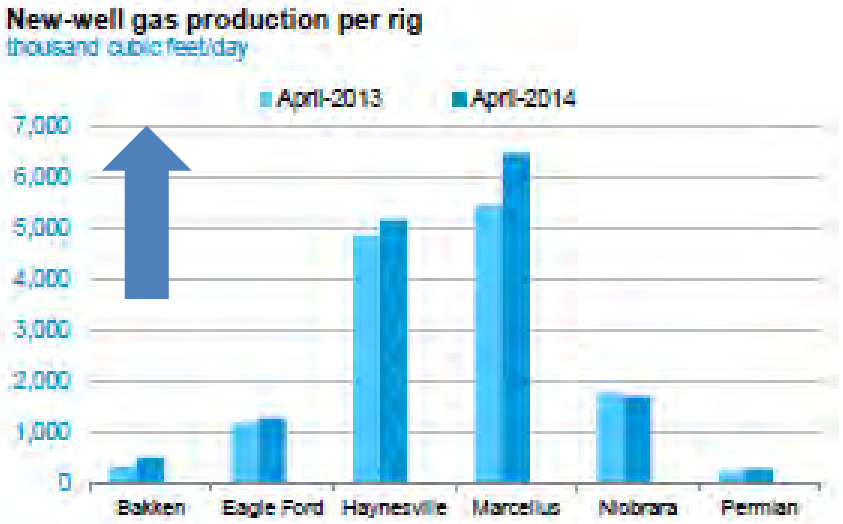
CEE analysis, EIA, state governments and other sources

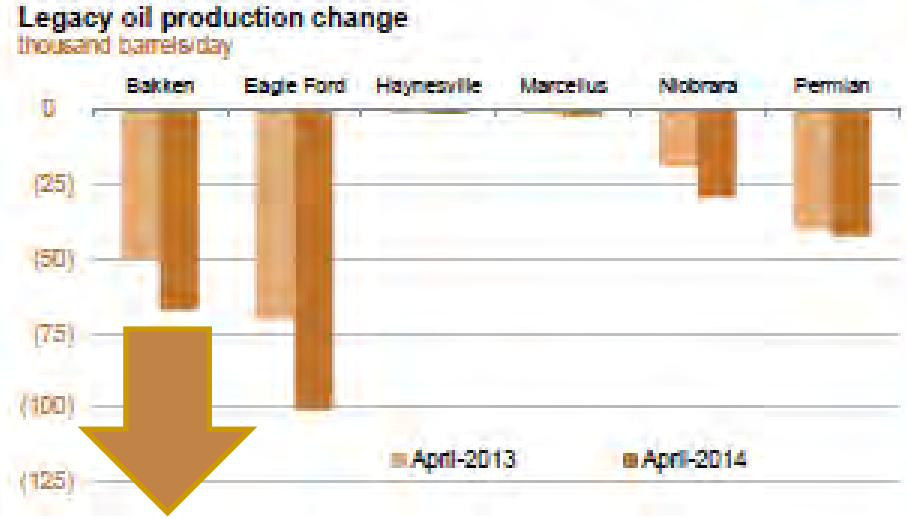
Working to Re-set the Treadmill

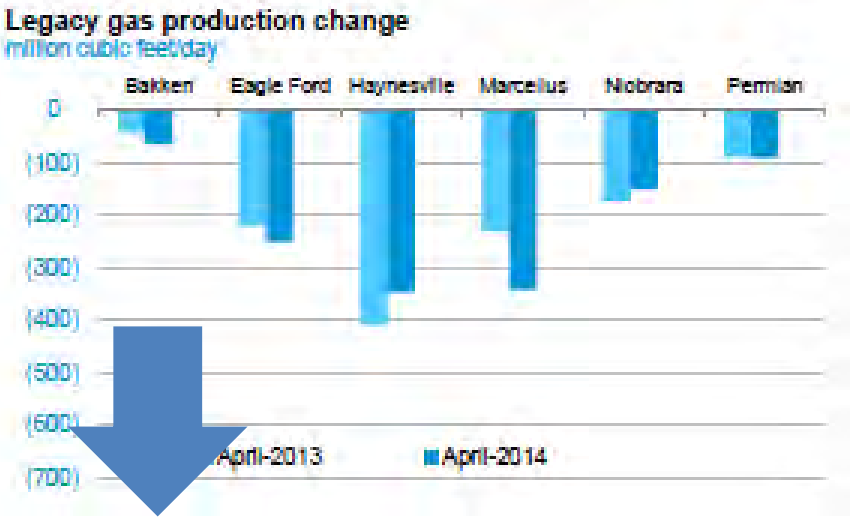
Oil and gas additions must offset, and exceed, decline curves impacts (large arrows).



As the best locations are "played out", more drilling in marginal locations will be required (higher cost, higher price).







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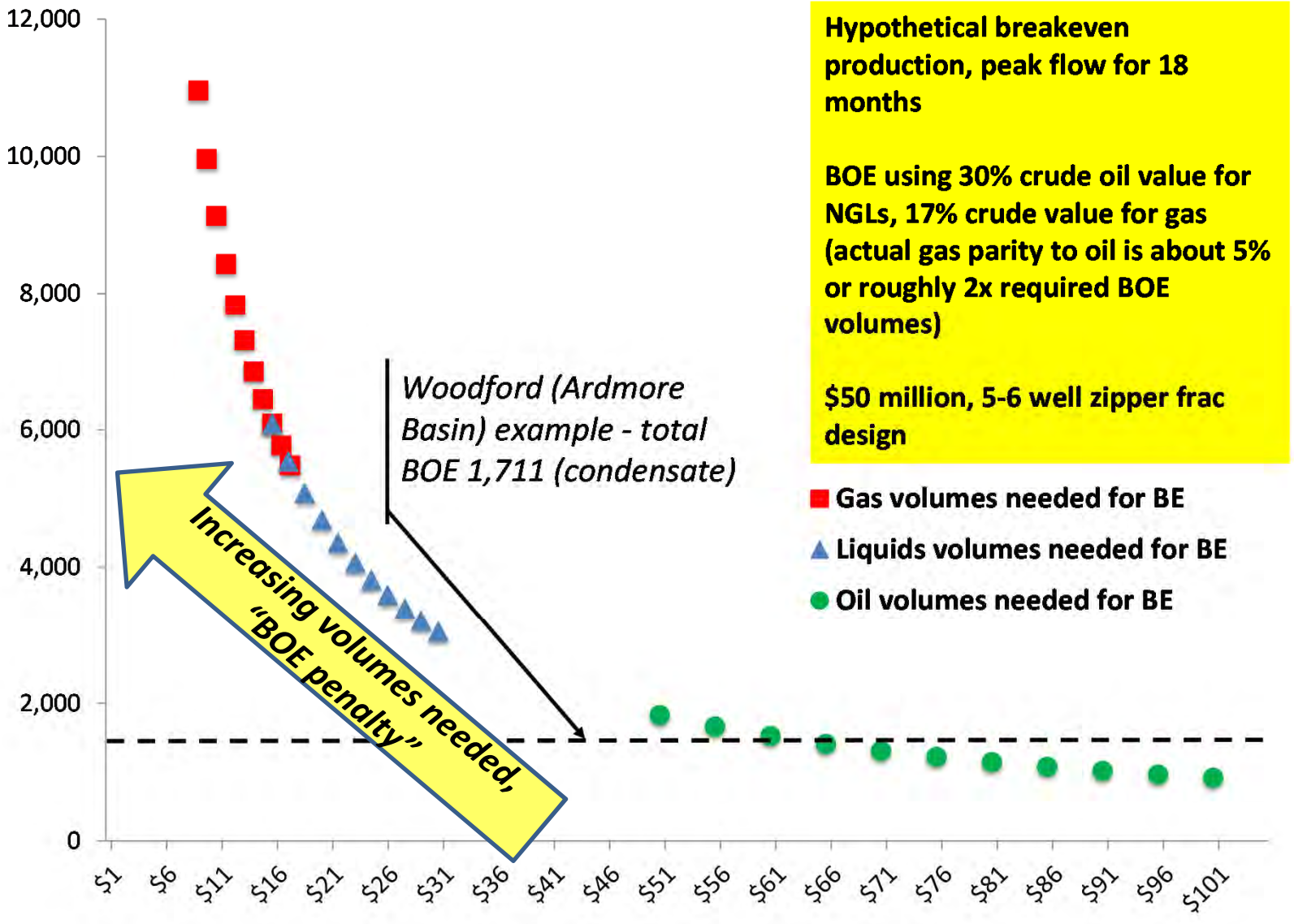
EIA Drilling Productivity Report, Feb 14, www.eia.gov

An Alternative View



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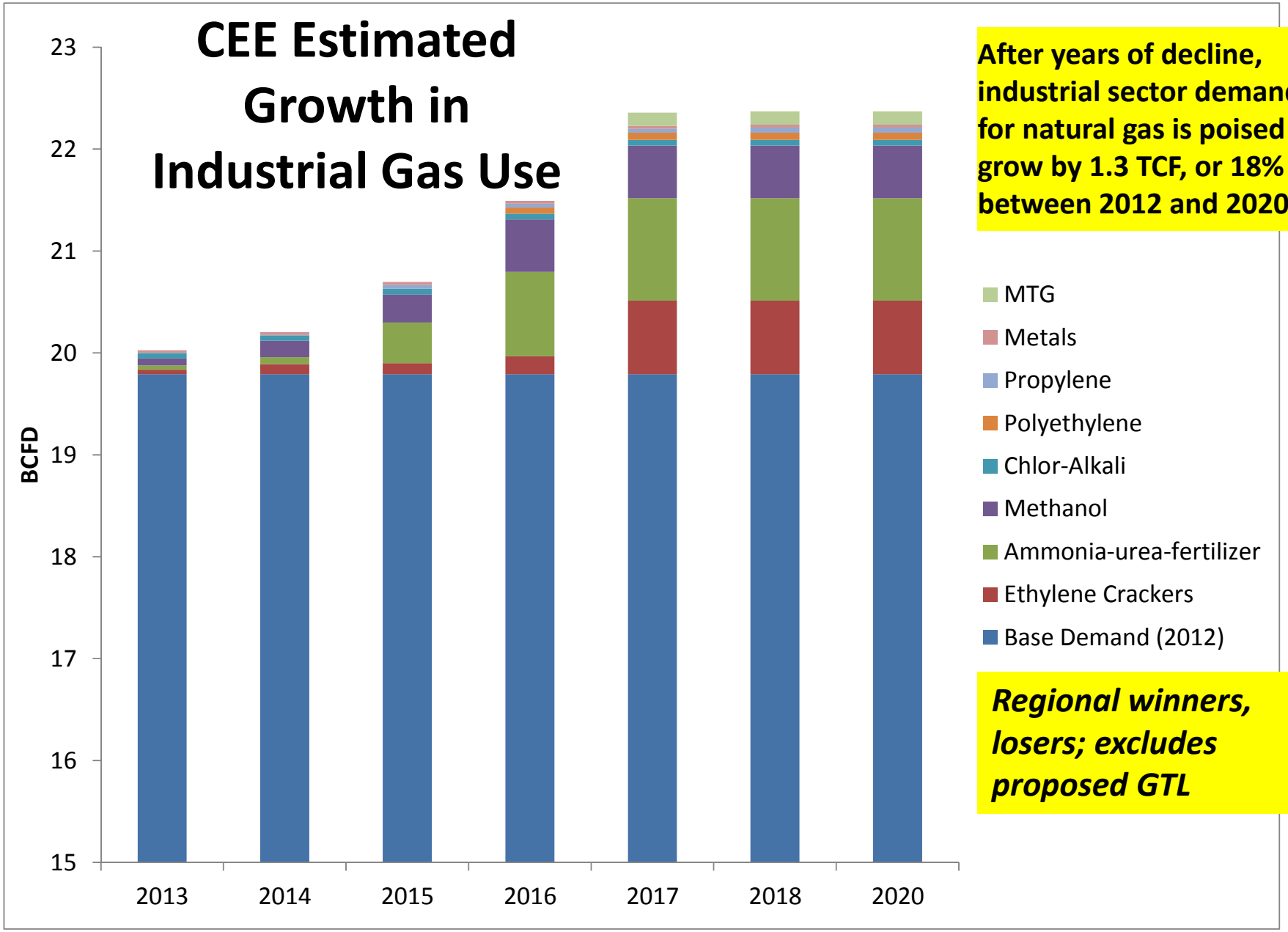
MM Foss, work in progress

CEE Estimated Growth in Industrial Gas Use



After years of decline, industrial sector demand for natural gas is poised to grow by 1.3 TCF, or 18% between 2012 and 2020.

Regional winners, losers; excludes proposed GTL

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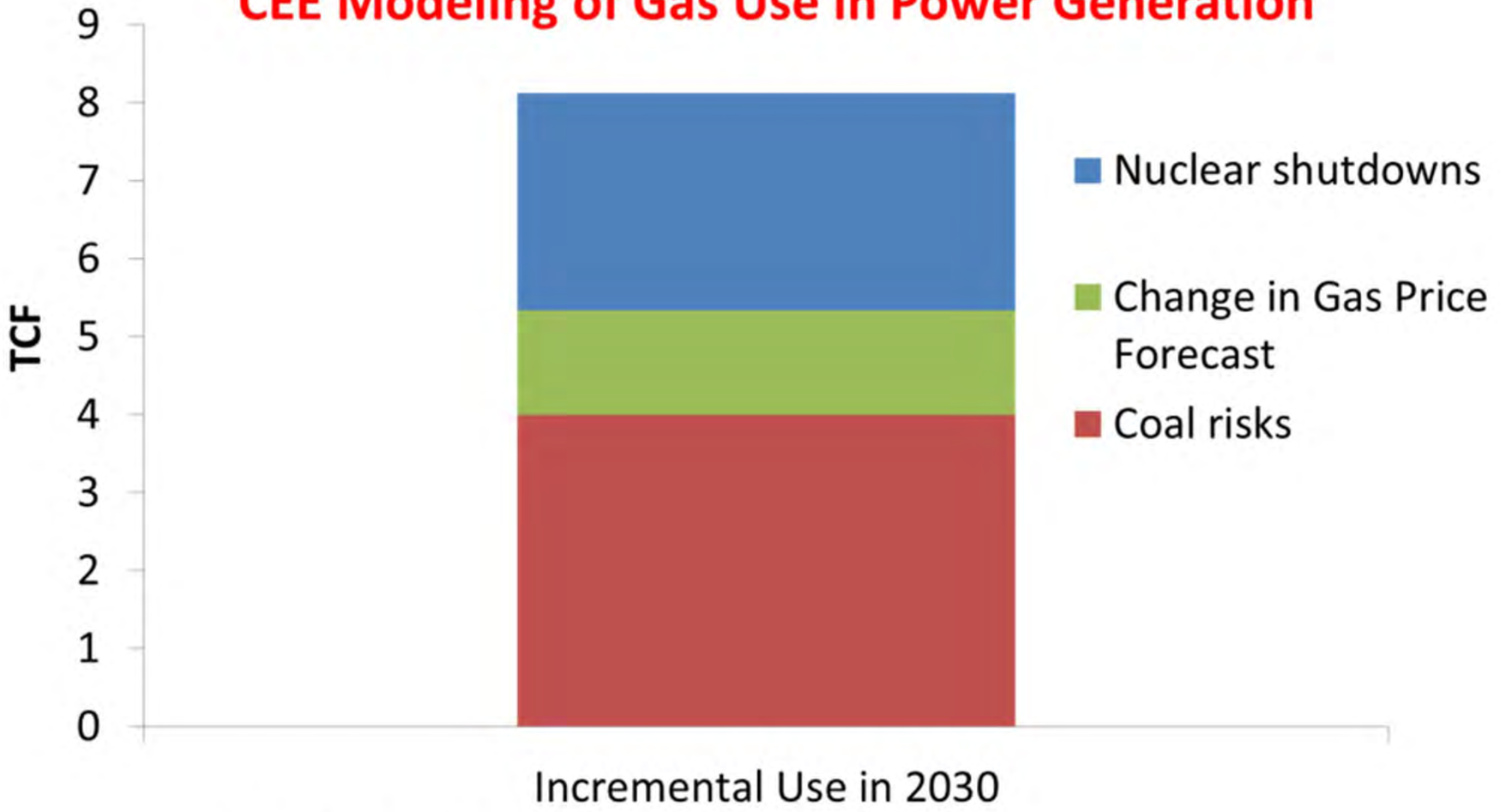
CEE Modeling of Gas Use in Power Generation



U.S. Gas-Power Linkages: Building Future Views for details: http://www.beg.utexas.edu/energyecon/thinkcorner/Think%20Corner%20Gas-Power%20Linkages.pdf

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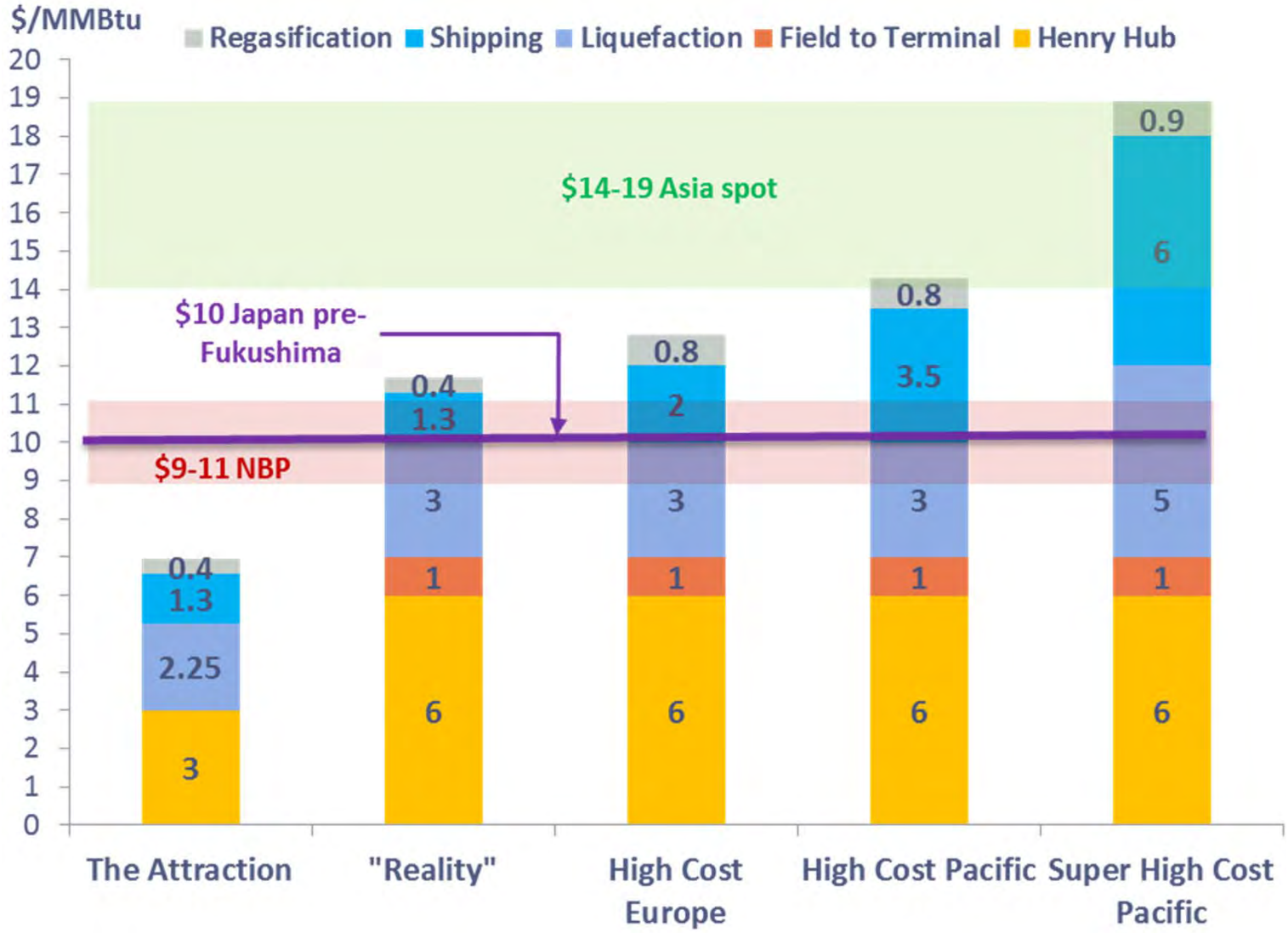
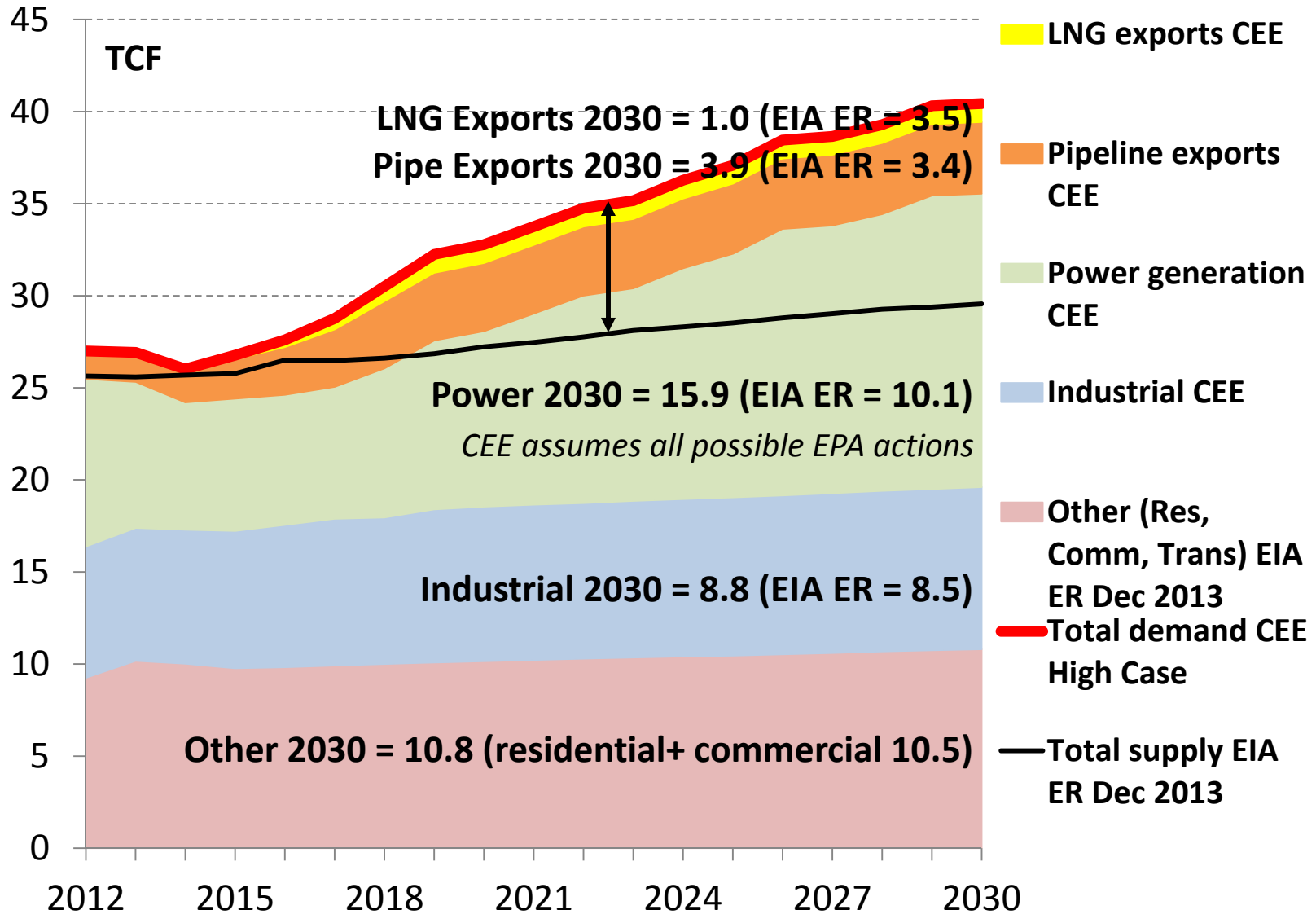
Is U.S. LNG Competitive?



A strong "demand stack" scenario



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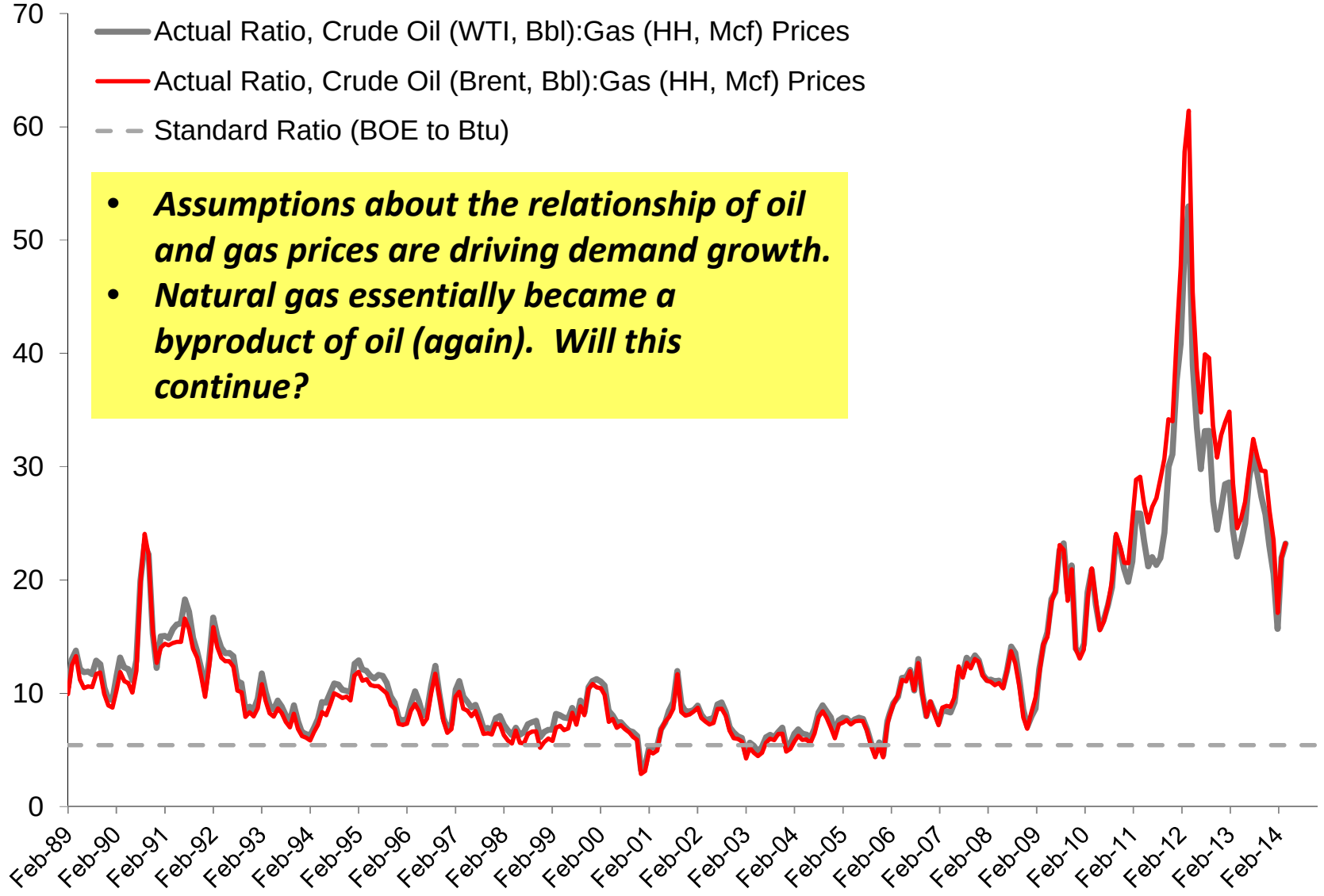
CEE analysis; EIA ER refers to EIA Early Release, Dec 2013 (reference case)

A driver…and an outcome



- ***Assumptions about the relationship of oil and gas prices are driving demand growth.***
- ***Natural gas essentially became a byproduct of oil (again). Will this continue?***

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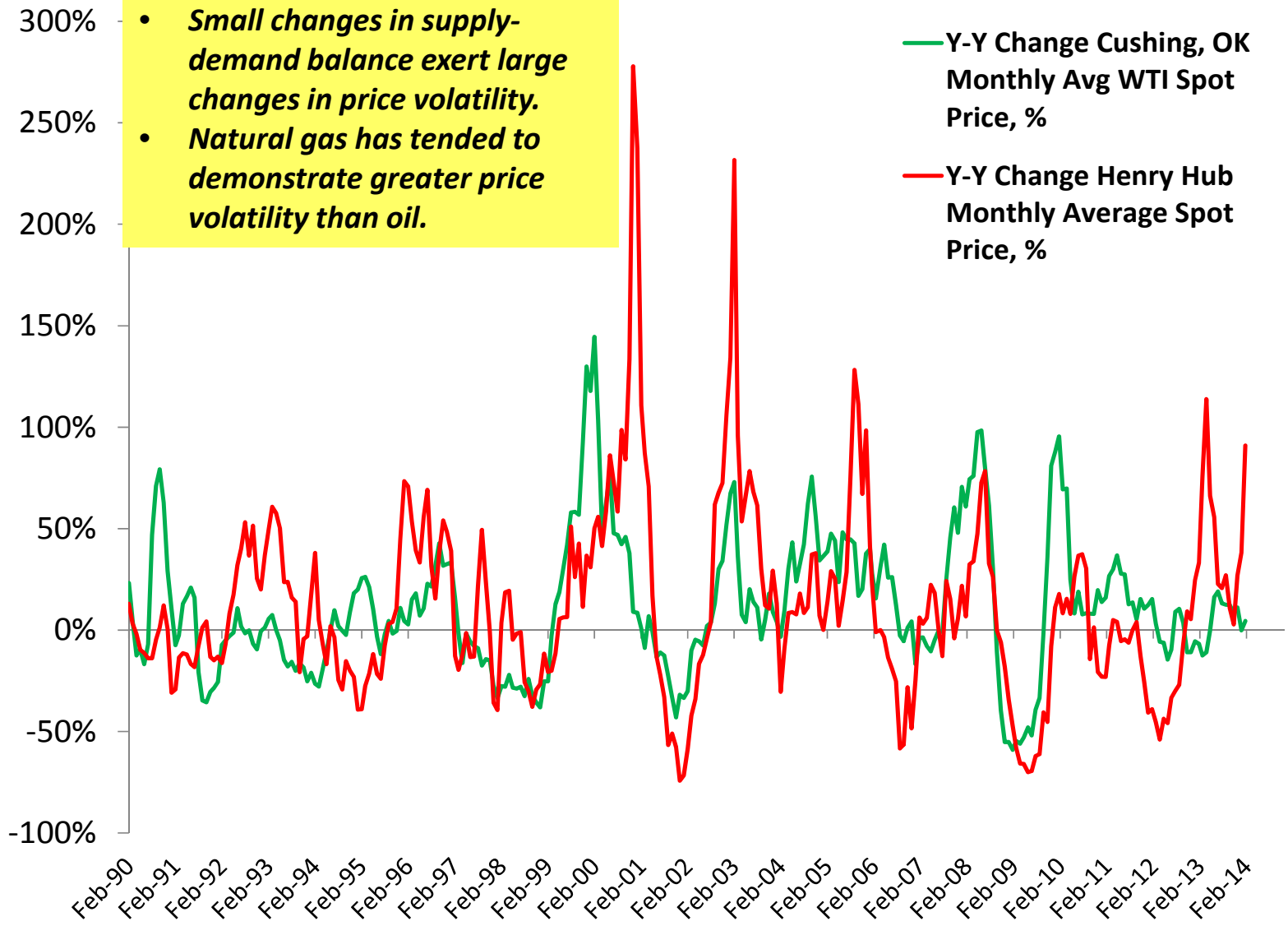
CEE analysis; EIA, CME/NYMEX data

Volatility Returns

- ***Small changes in supply-demand balance exert large changes in price volatility.***
- ***Natural gas has tended to demonstrate greater price volatility than oil.***



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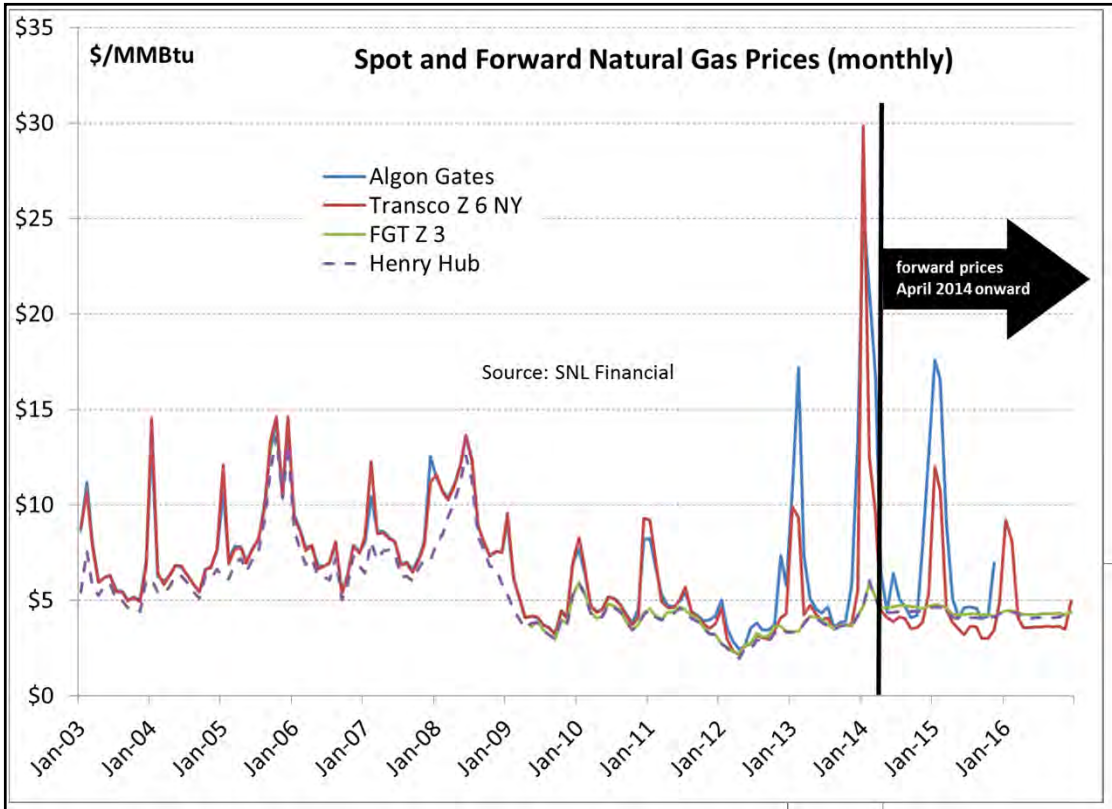
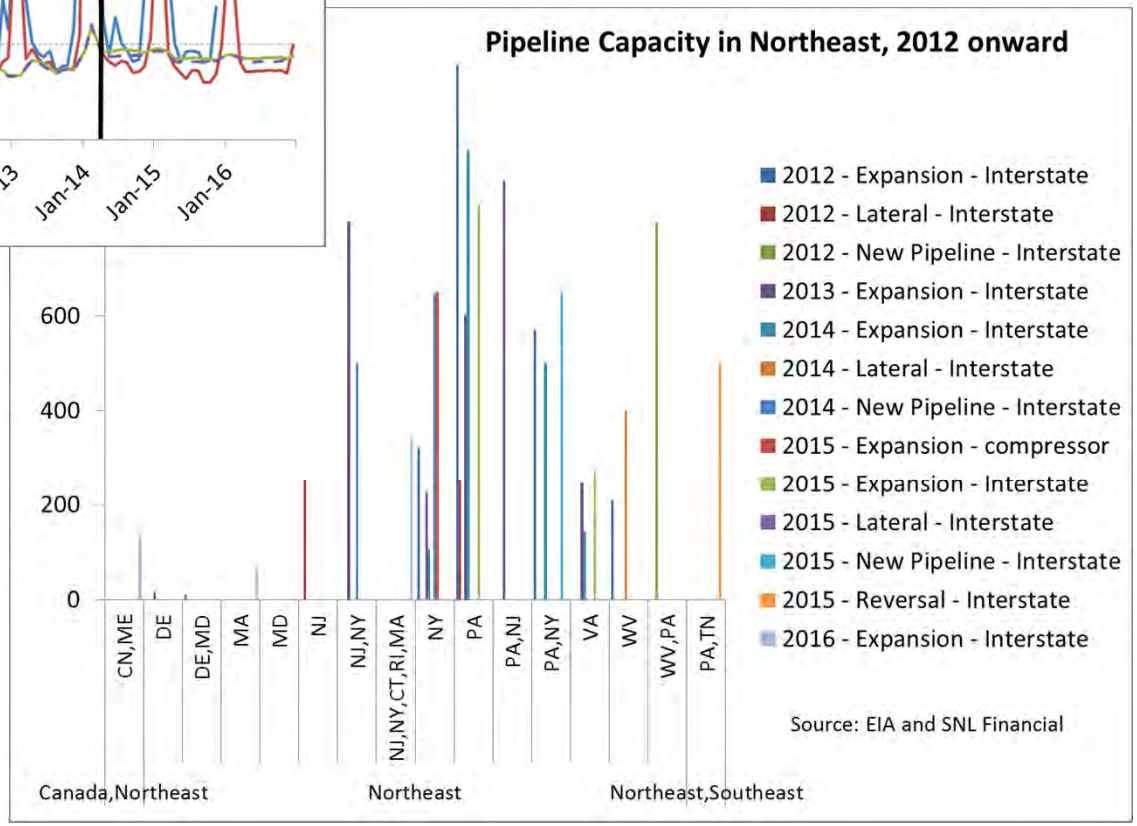
Big Market, Many Bottlenecks





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Burden of Proof

All are approximations (TCF)	Start	Cum Gas to 2012	Cum Gas to 2050 (BEG)	Remaining in Place as of 2012
Barnett	[1]1982	13.0 (BEG)	32.0	48 (PGC)
Fayetteville (incl. Woodford)	2004	2.5 (BEG)	15.5	104 (PGC, incl. Woodford)
Haynesville	2006-08	6.0 (PSD)	34.0	149 (PGC)
Eagle Ford	2005	0.7 (PSD)	?	?
Bakken/Three Forks	1986	0.5 (PSD)	?	?
Marcellus	2005-09	3.7 (PSD)	?	563 (PGC, incl. Utica)
[2]Gulf of Mexico (64% decline since 1997 peak of 5 TCF)	1970s	[3]151 (EIA)	?	75 (PGC)
[2]Western Canada Sedimentary Basin (15% decline since 2000-06 average of 5.8 TCF)	1970s	[4]161 (CAPP)	?	[4]66 (CAPP)

To replace GOM and WCSB supply, shale plays need considerable development with attendant risks, uncertainties.

Notes: [1]most wells and horizontal completions drilled since 1990s; [2]production ramp-up in 1970s; [3]mainly GOM shelf; [4]marketed production and marketable gas reserves; forthcoming CEE case studies on GOM shelf and WCSB development pathways

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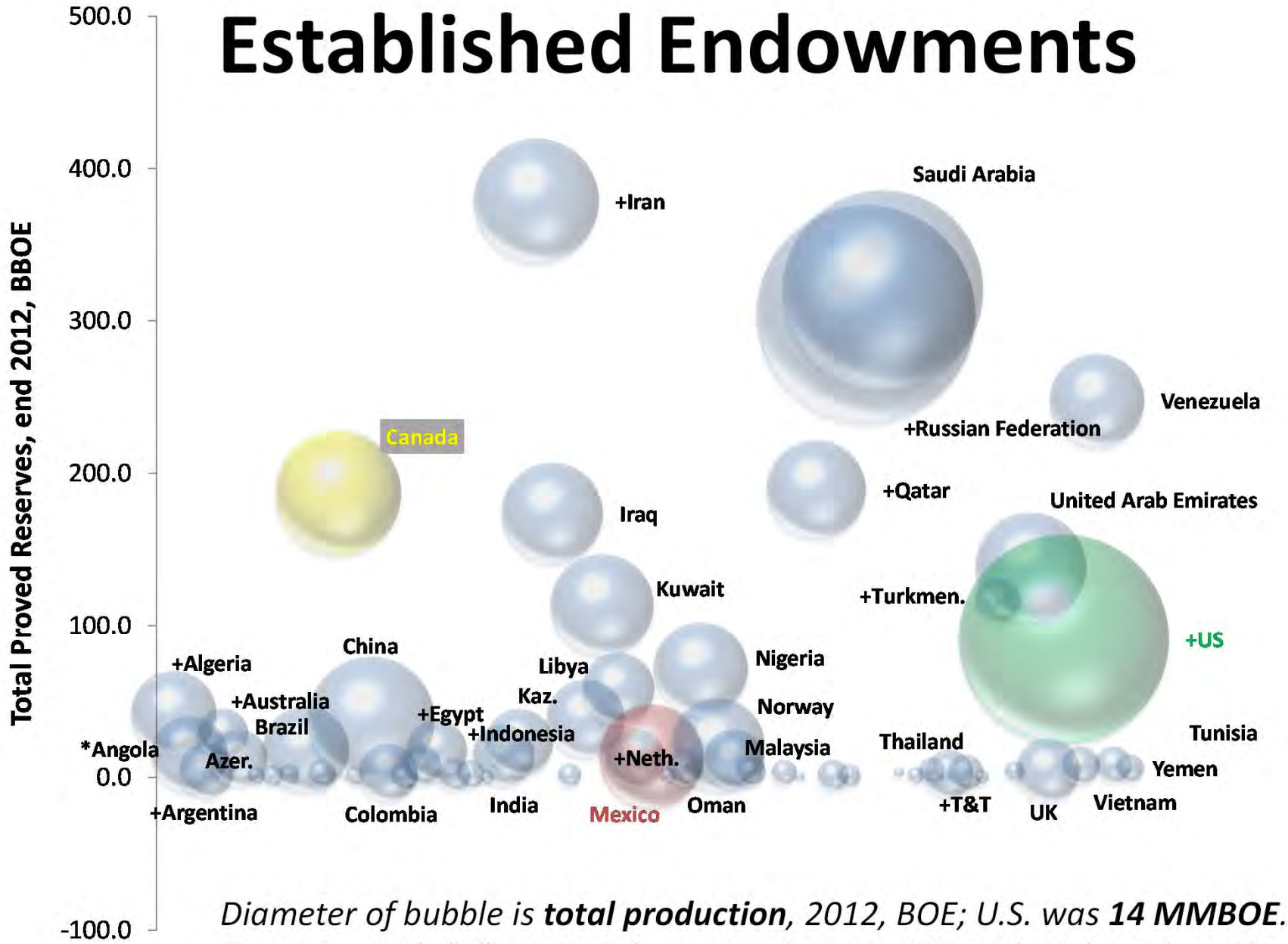
BEG Sloan; Powell Shale Digest; Potential Gas Committee; Canadian Association of Petroleum Producers

Established Endowments



*Diameter of bubble is **total production**, 2012, BOE; U.S. was **14 MMBOE**. Countries with "+" are mainly gas producers. CEE analysis based on BP Statistical Review and EIA.*

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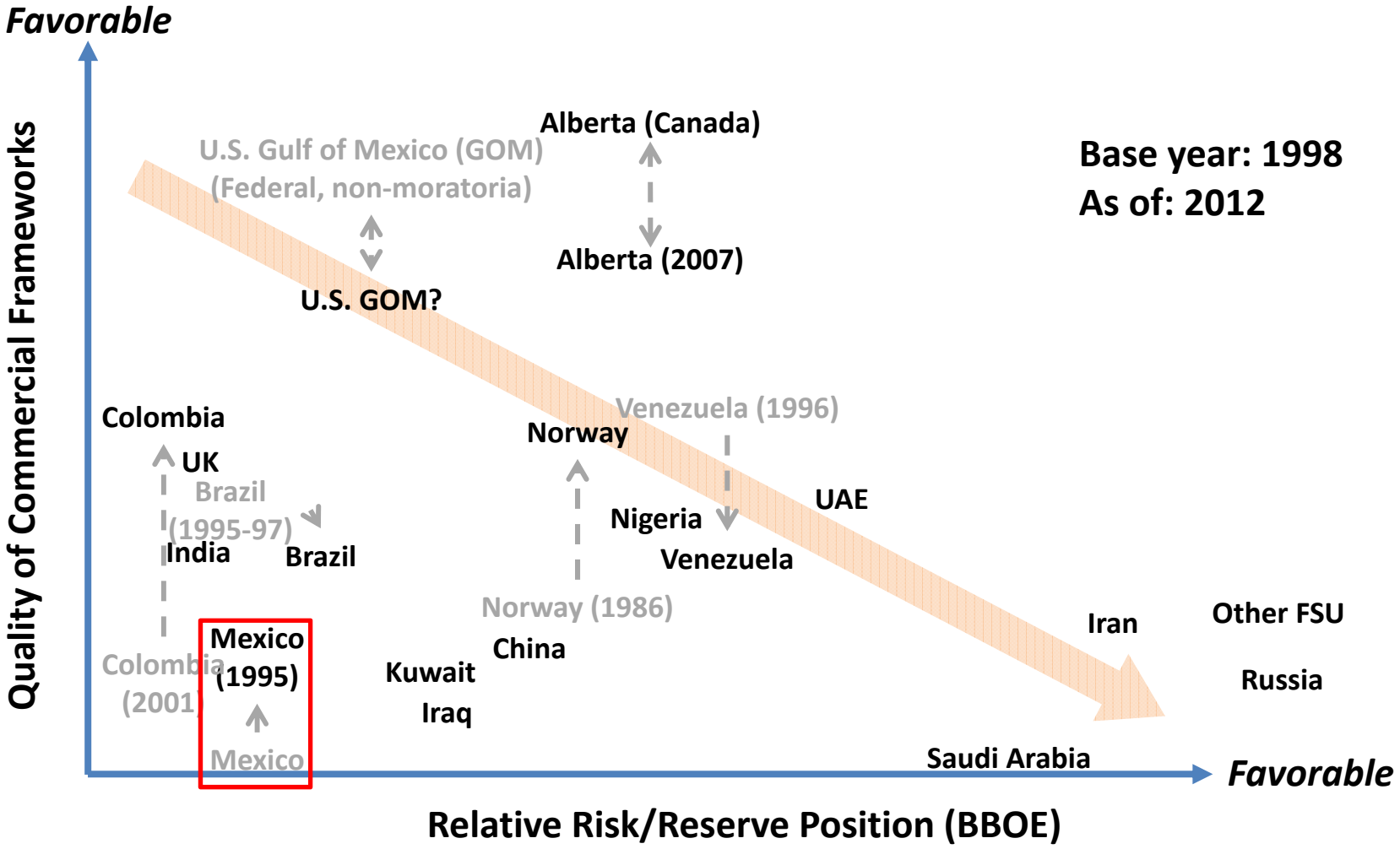
Upstream Regimes: Inverse Relationship



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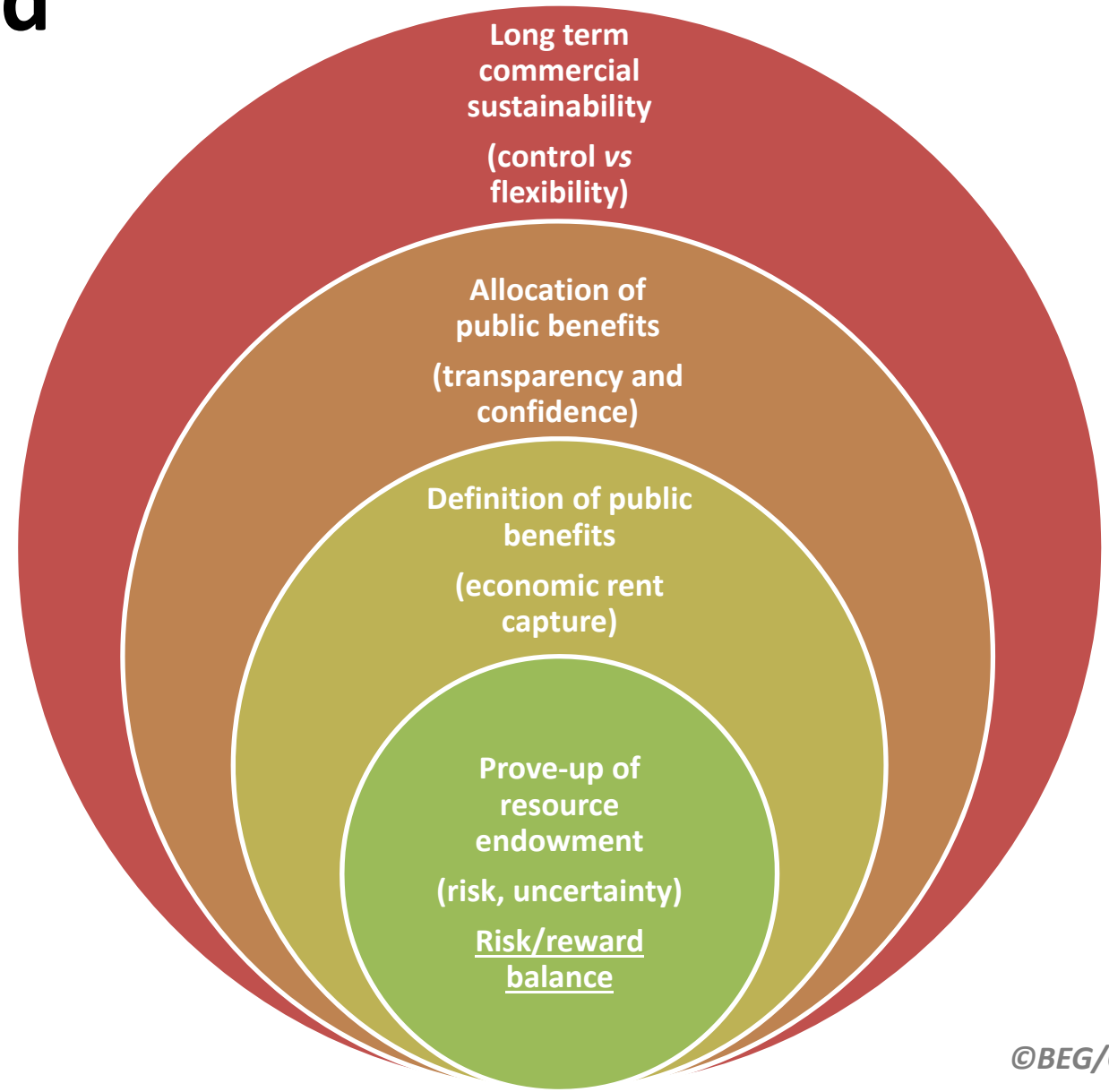
Source: Approximations, only. Based on Foss, et.al., 1998.

Key Challenges: Mexico and Beyond



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Broader Lessons

- Free enterprise matters!
  - Cannot "pick winners"
- Access is key to flexible development
  - Regulatory red tape, public opposition are equally bad – "time is money"
- National oversight makes sense for large infrastructure
  - But local control is desired and desirable
- Investment won't happen without clear price signals