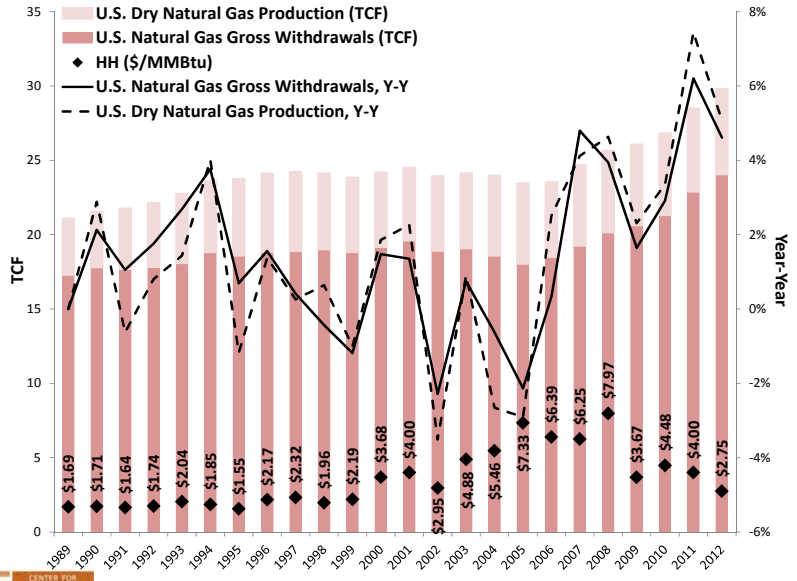
¿Hacia un nuevo mercado de gas natural?

El Colegio de México, 19 November 2013

Overall Observations: YE 2013

- **Resources ≠ Reserves**
  - Deliverability is key
- "Sweet spot" geology
  - Shale "silos"
- Liquids are critical to well economics
  - Will shift to liquids reduce **methane** production capacity?
- Demand build-out is real
  - Midstream, logistics challenges
- Adventures by 2020 (or sooner)
  - *Surprises in "long" and "short" positions?*

A Long and Winding Road



EIA, CME/NYMEX, CEE analysis

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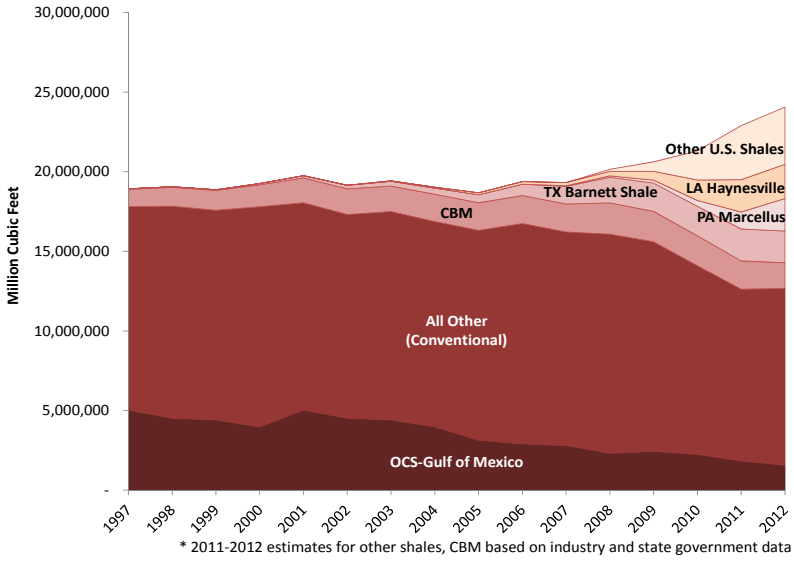
U.S. Dry Gas Production by Type



* 2011-2012 estimates for other shales, CBM based on industry and state government data

CEE analysis, EIA, state governments and other sources

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Dry Gas Production Growth Trends

	2009-2010	2010-2011	2011-2012
U.S. Dry Natural Gas Production	3%	7%	5%
Other U.S. Shales	206%	*86%	*6%
LA Haynesville	*133%	*58%	*6%
PA Marcellus	100%	189%	92%
TX Barnett Shale	4%	9%	-1%
CBM	-1%	*-6%	*-9%
All Other (Conventional)	*-10%	*-9%	*3%
OCS-Gulf of Mexico (GOM)	-8%	-18%	*-15%

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

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CEE analysis, EIA, state governments and other sources

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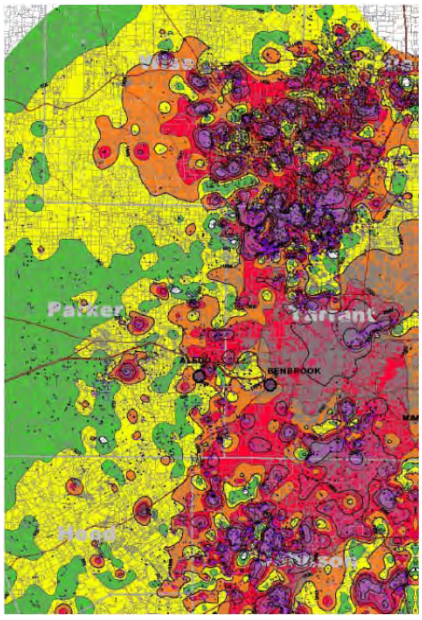
All Shale Is Not the Same, 2009

Estimated ultimate recoveries per well (Barnett):

Isopach	BCF
"Sweet Spot" (dark purple)	3.0+
Second	2.5-3.0
Third	1.75 – 2.5
Fourth	1.25 – 1.5
Fifth	0.5 – 1.25
Sixth (green)	<0.5

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



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Proprietary Report, 2009

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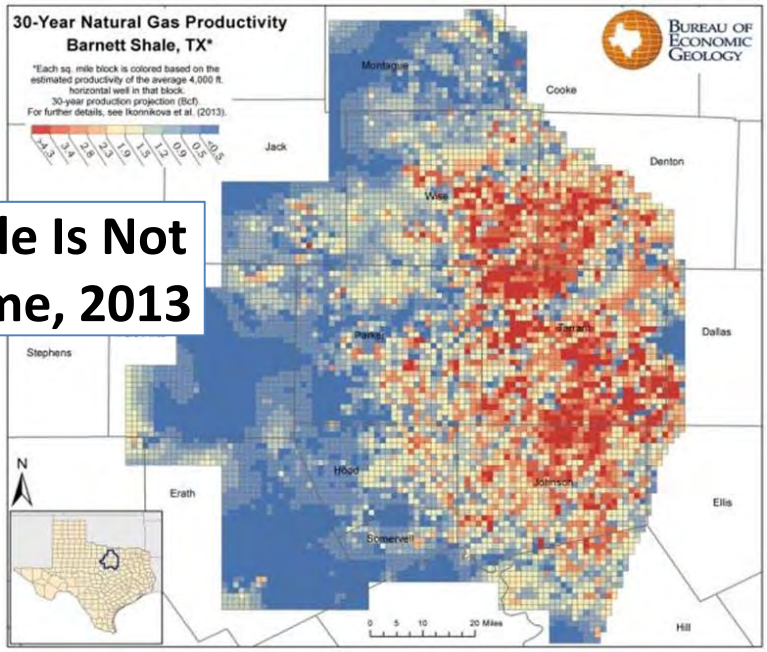
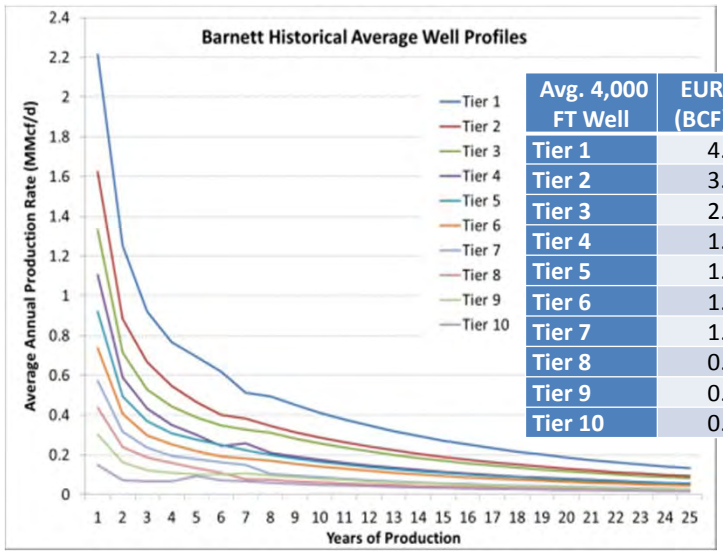
All Shale Is Not the Same, 2013



BEG, http://www.jsg.utexas.edu/news/2013/02/frequently-asked-questions-faq-beg-barnett-shale-assessment-study/, 2013

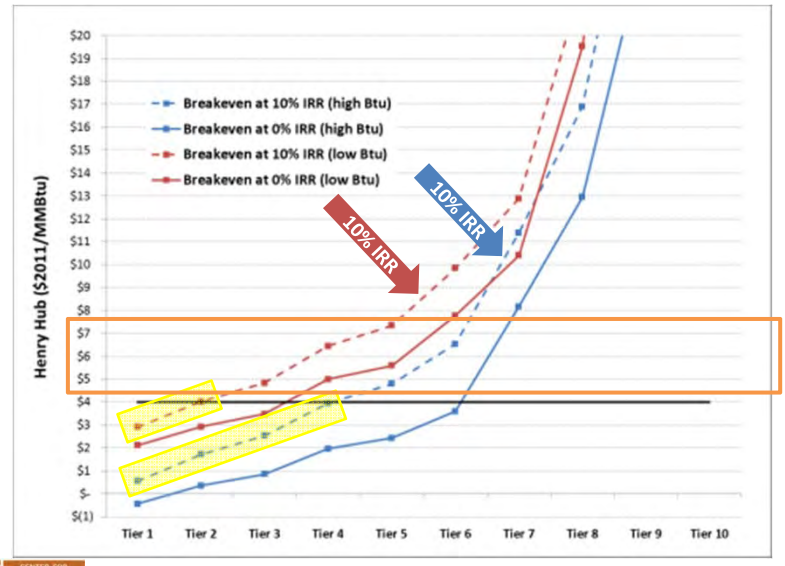
From isopachs to tiers…



Avg. 4,000 FT Well	EUR (BCF)	Well Life (Btu) Low	Well Life (Btu) High
Tier 1	4.3	25	25
Tier 2	3.0	24	25
Tier 3	2.6	21	25
Tier 4	1.9	15	25
Tier 5	1.7	15	25
Tier 6	1.4	11	24
Tier 7	1.0	9	13
Tier 8	0.8	5	10
Tier 9	0.7	3	8
Tier 10	0.4	2	3

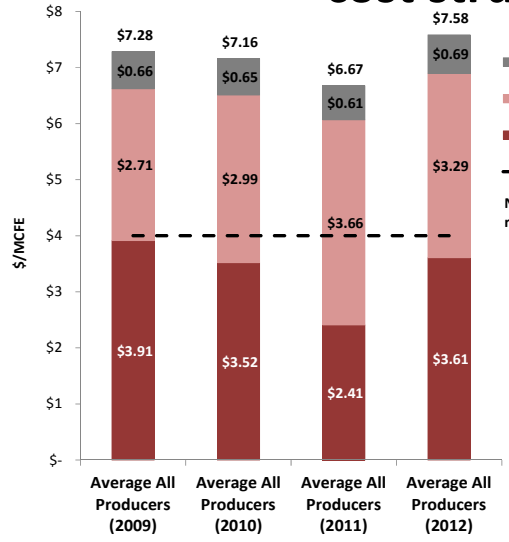
Tinker, et.al., 2013, OGJ

…from tiers to well economics…



Tinker, et.al., 2013, OGJ

…from well economics to producer cost structure



10% Return
U.S. Cash Operating Costs $/MCFE
U.S. All Source FD Costs $/MCFE
Henry Hub Spot Price $4/MCF

Note: All Source FD Costs are 3-year rolling averages

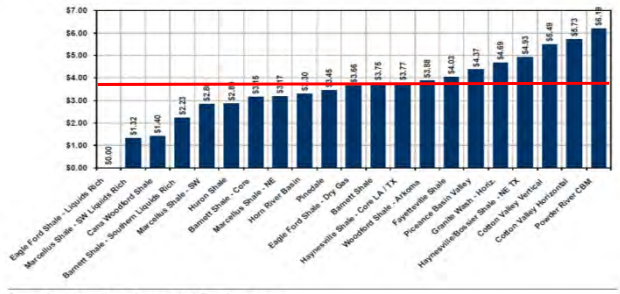
VERY PRELIMINARY

"Exploration groups love shale – they can book a billion BOE. No one thinks about the 6,000 wells the production company has to drill."

2012-2013 indicators:

- **Costs remain high (oil price infl.)**
- **Spending well above CF (including liquids)**
- **Write downs (not just for gas)**
- **Credit deterioration……**

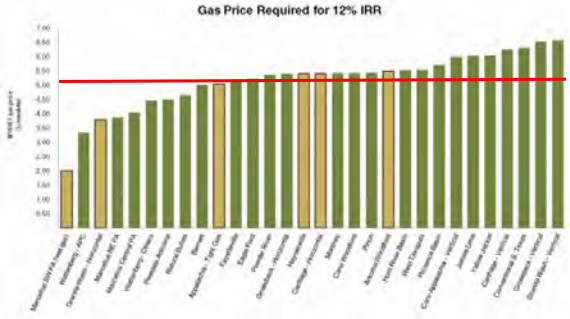
CEE based on corporate reports



Source: Credit Suisse Equity Research Oil & Gas team estimates

Problem: Well Economics at Basin Level Ignore Critical Producer Costs

Two analyses, different assumptions – about $1 more per MMBtu required in 12% IRR case



Credit Suisse (2012); MarkWest Energy Partners (Goldman Sachs, 2012)

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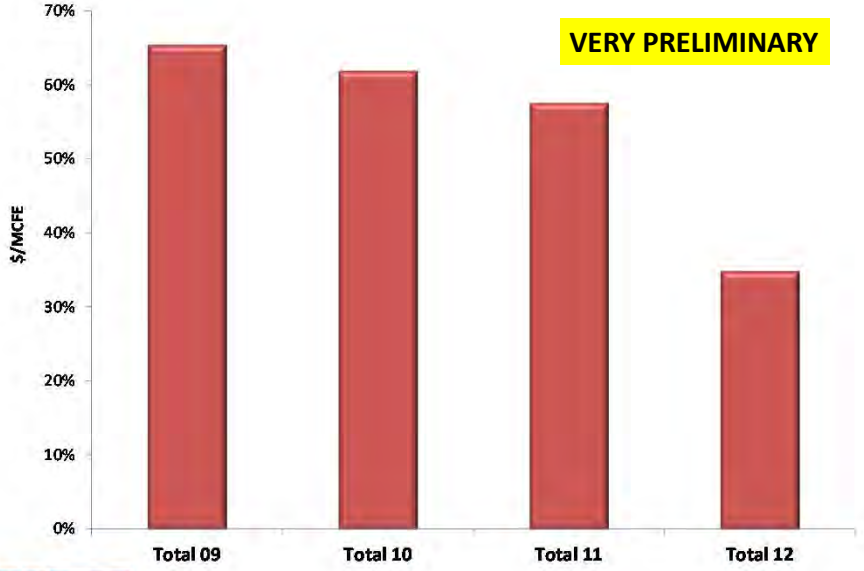
Natural Gas % All Source Additions

VERY PRELIMINARY



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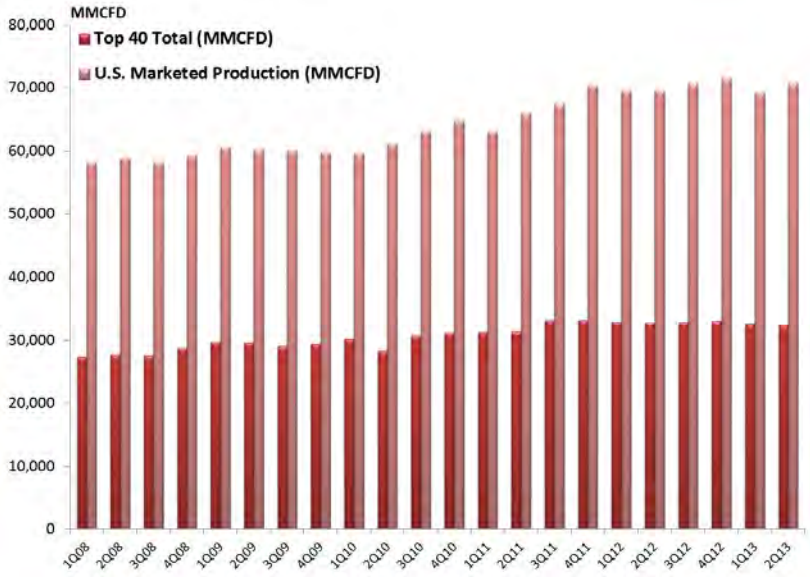
CEE based on corporate reports

Change at Corporate Level Leads EIA



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CEE based on corporate reports; EIA

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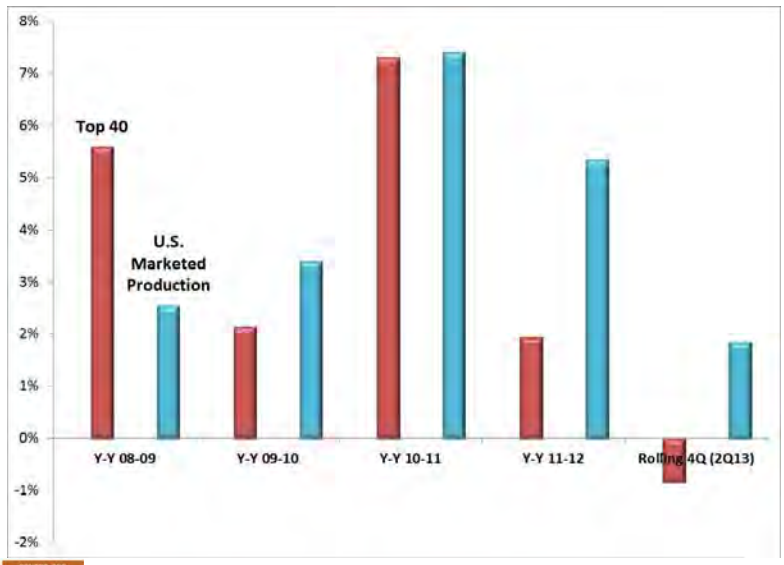
Change at Corporate Level Leads EIA



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CEE based on corporate reports; EIA

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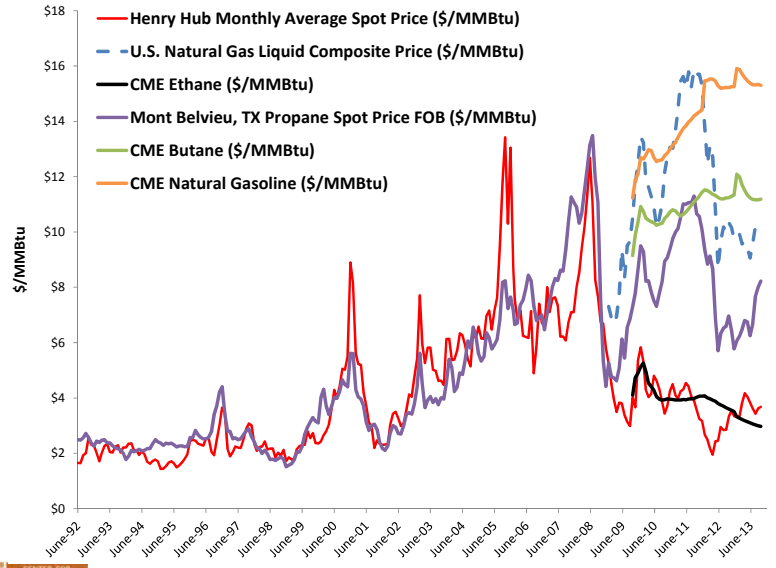
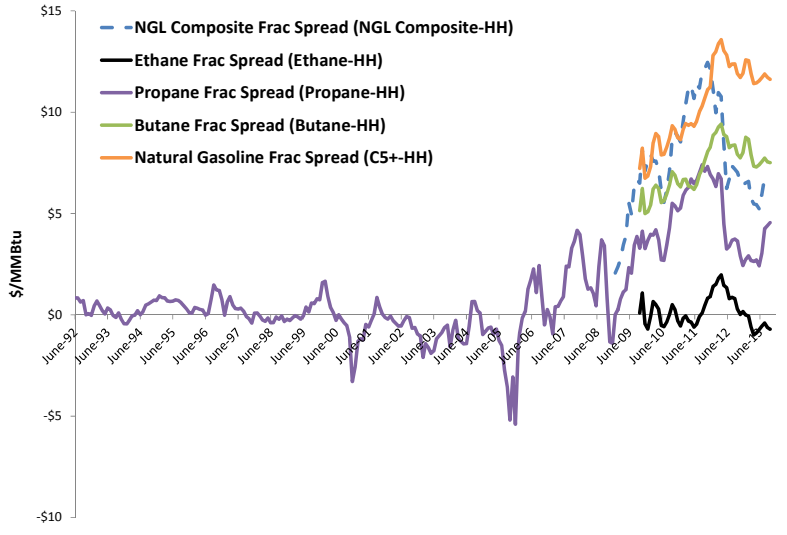
Drivers: shifting value propositions…



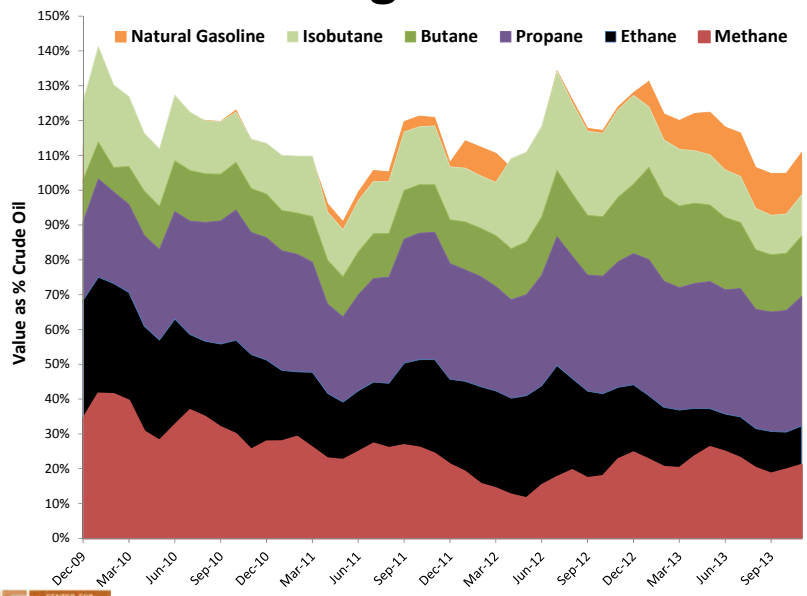
CEE based on EIA, CME/NYMEX

…and more complicated economics…



CEE based on EIA, CME/NYMEX

…but few as good as black oil



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CEE based on EIA, CME/NYMEX

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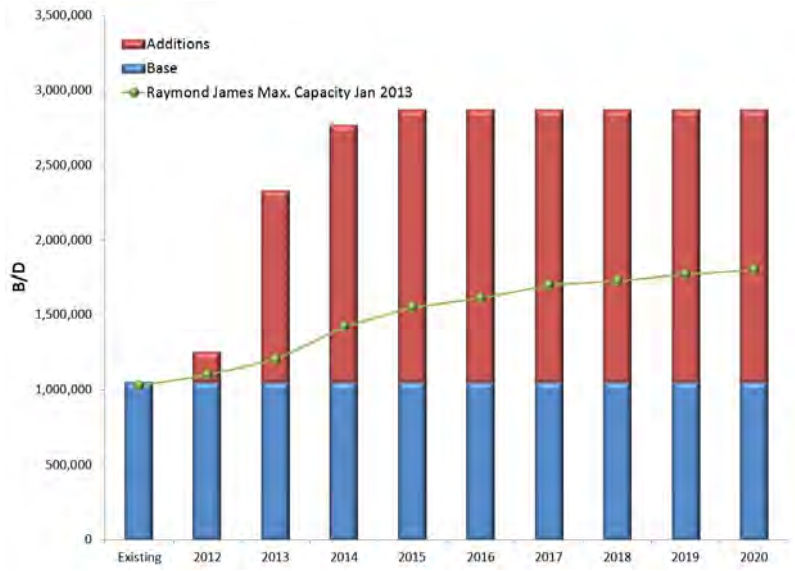
U.S. Ethane Fractionation



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CEE inventory based on industry data

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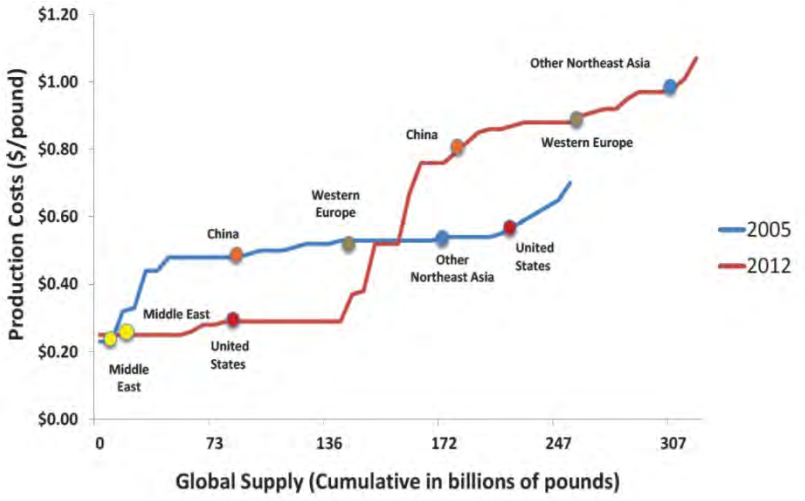
Ethylene Global Cost Curve – Easy to Overbuild



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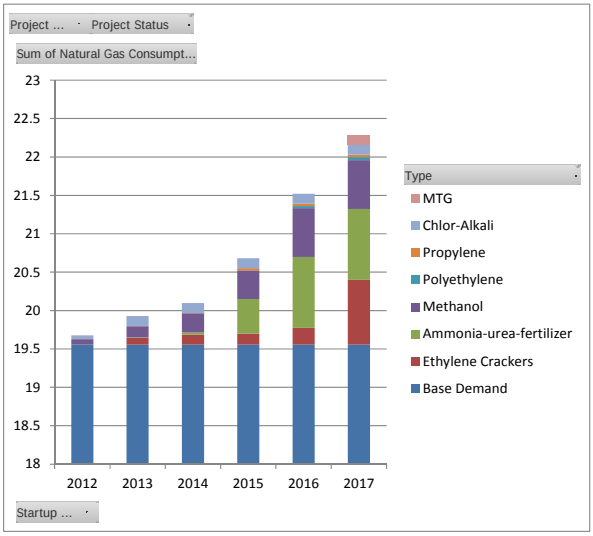
American Chemistry Council

U.S. Petrochemical Demand for Gas



- **Revised and corrected, October 18**
- **Excludes non-petrochemical industrial demand as well as gas for industrial CHP and other boilers**
- **New indications that industrial boilers are being shifted to gas in anticipation of EPA MACTS although final rules are pending**

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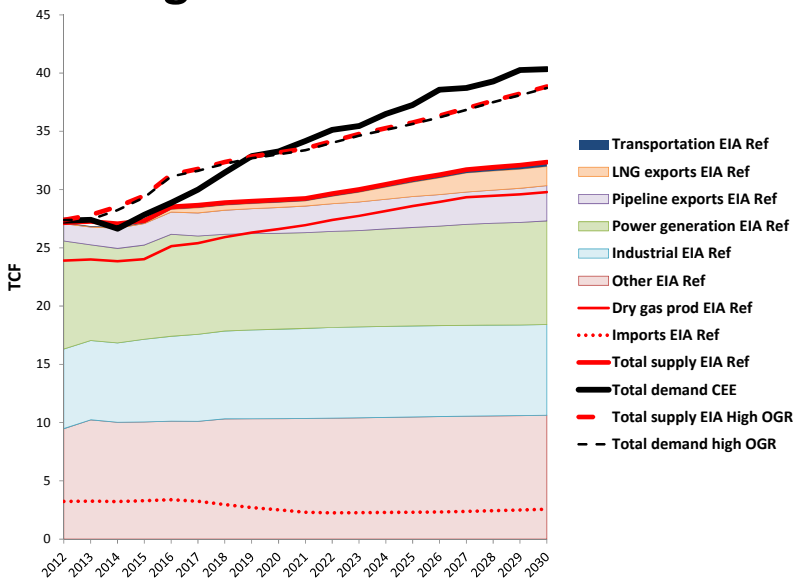
CEE inventory as of August 2013 based on industry data

A strong "demand stack" scenario…



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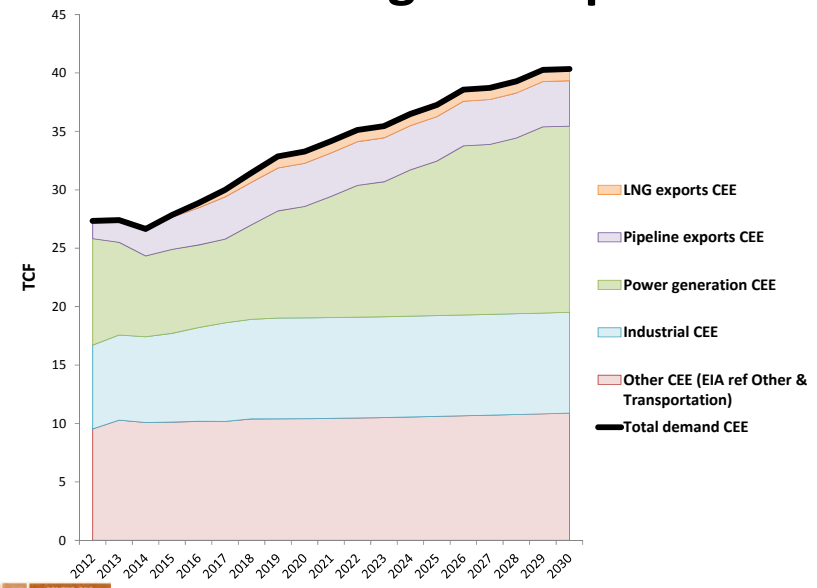
CEE analysis; EIA AEO cases

…with strong assumptions



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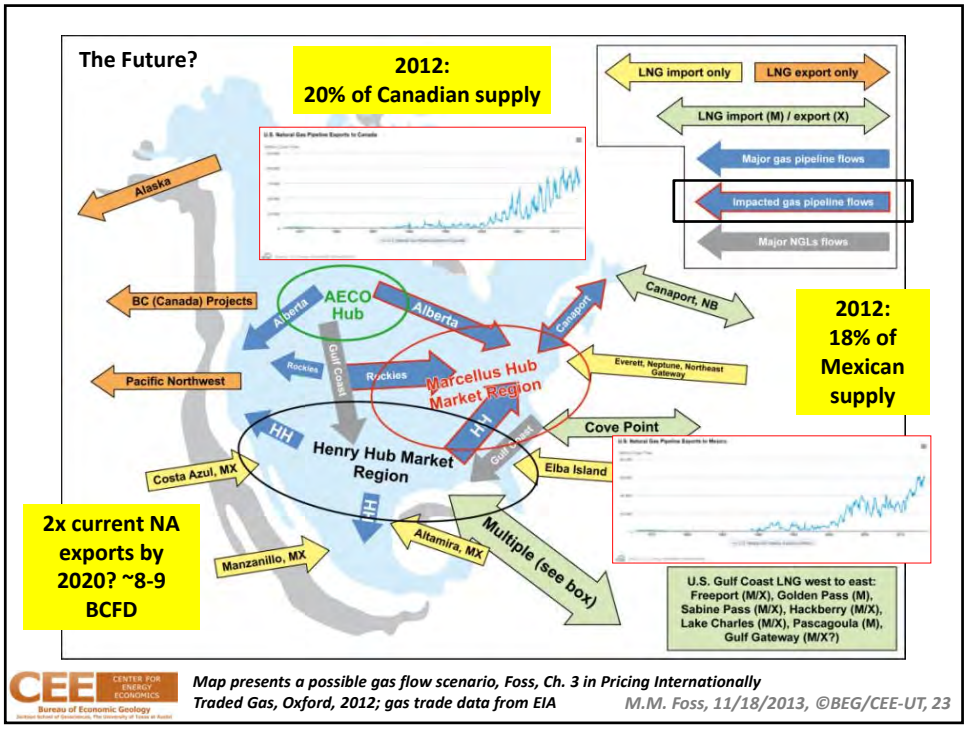
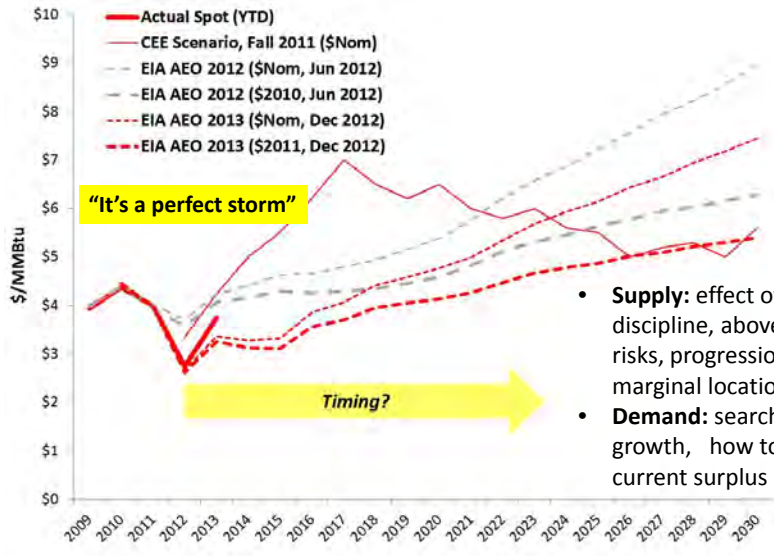
CEE analysis



Map presents a possible gas flow scenario, Foss, Ch. 3 in Pricing Internationally Traded Gas, Oxford, 2012; gas trade data from EIA

M.M. Foss, 11/18/2013, ©BEG/CEE-UT, 23

Natural Gas Price: Test Case



- **Supply:** effect of producer discipline, above ground risks, progression to more marginal locations
- **Demand:** search for organic growth, how to balance current surplus

Foss, Gulen, Wainberg, Oil & Gas Investor, September 2013

M.M. Foss, 11/18/2013, ©BEG/CEE-UT, 24

Burden of Proof

All are approximations (TCF)	Start	Cum Gas to 2012	Cum Gas to 2050 (BEG)	Remaining as of 2012
Barnett	[1]1982	13.0 (BEG)	32	48 (PGC)
Fayetteville (incl. Woodford)	2004	2.5 (BEG)	15.5	104 (PGC, incl. Woodford)
Haynesville	2006-08	6.0 (PSD)		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)
[3]Gulf of Mexico (64% decline since 1997 peak of 5 TCF)	1970s	[2]151 (EIA)		75 (PGC)
[3]Western Canada Sedimentary Basin (15% decline since 2000-06 average of 5.8 TCF)	1970s	[4]161 (CAPP)		[4]66 (CAPP)

Notes: [1]most wells and horizontal completions drilled since 1990s; [2]mainly GOM shelf; [3]production ramp-up in 1970s; [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