

# Finding Petroleum

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## How Unconventionals Fit Into The Global Production Picture

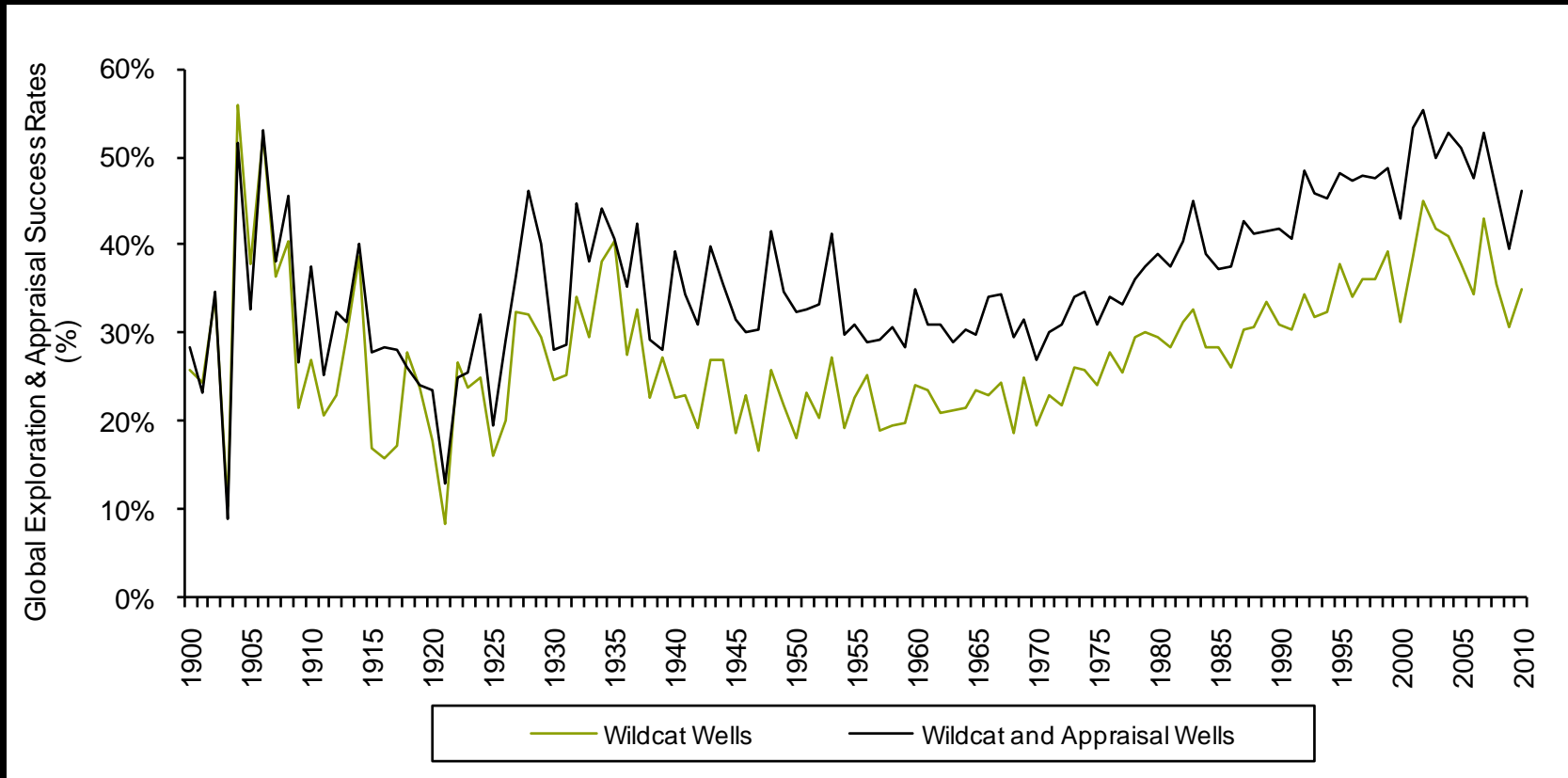
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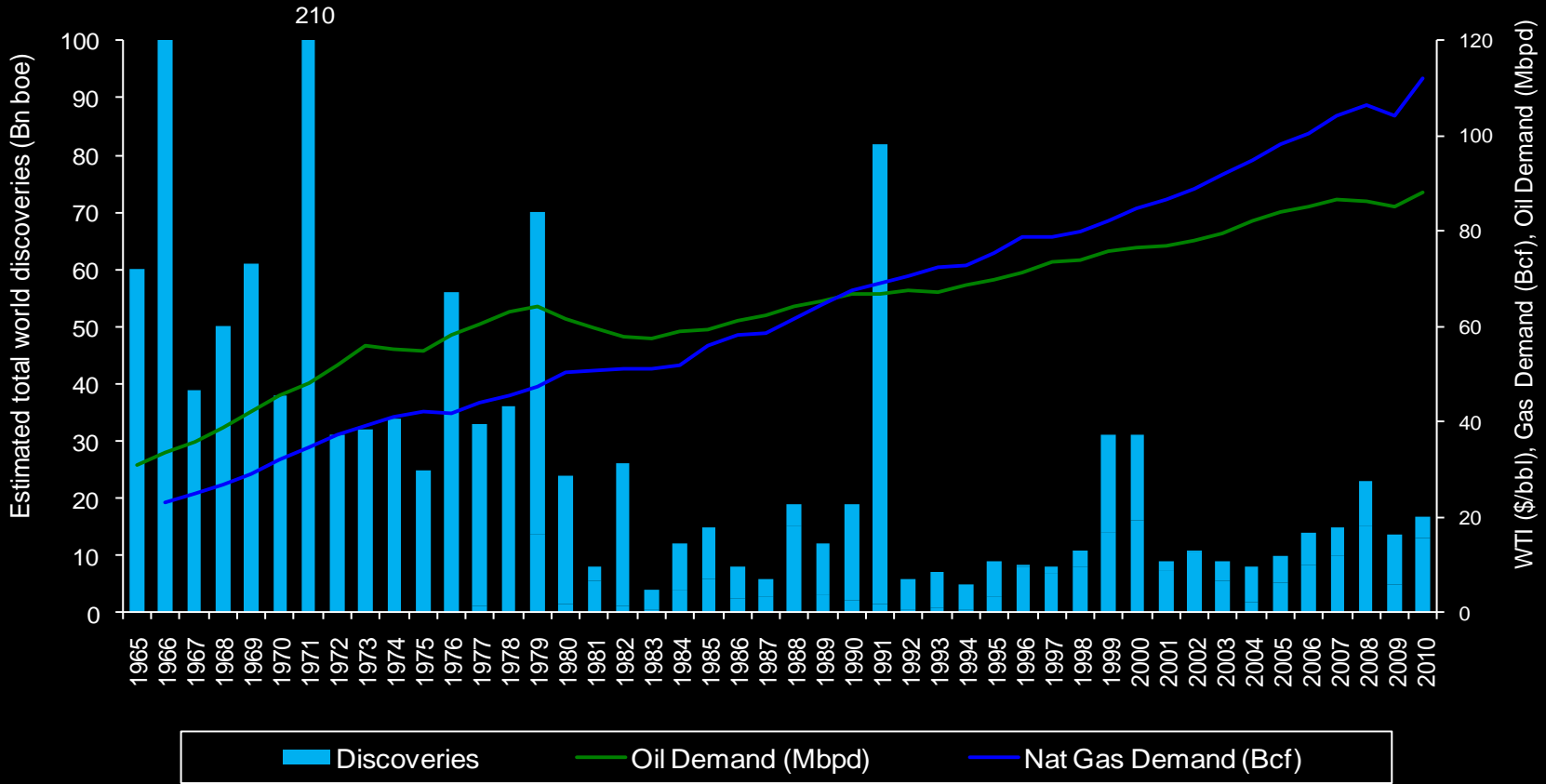
# Introduction

- Incentives for unconventional exploration
- The US Success Case
- Repeating this success globally
- Resulting impact on global oil and gas production
- Summary

# Inability of conventional exploration to match consumption will continue to drive the search for unconventionals



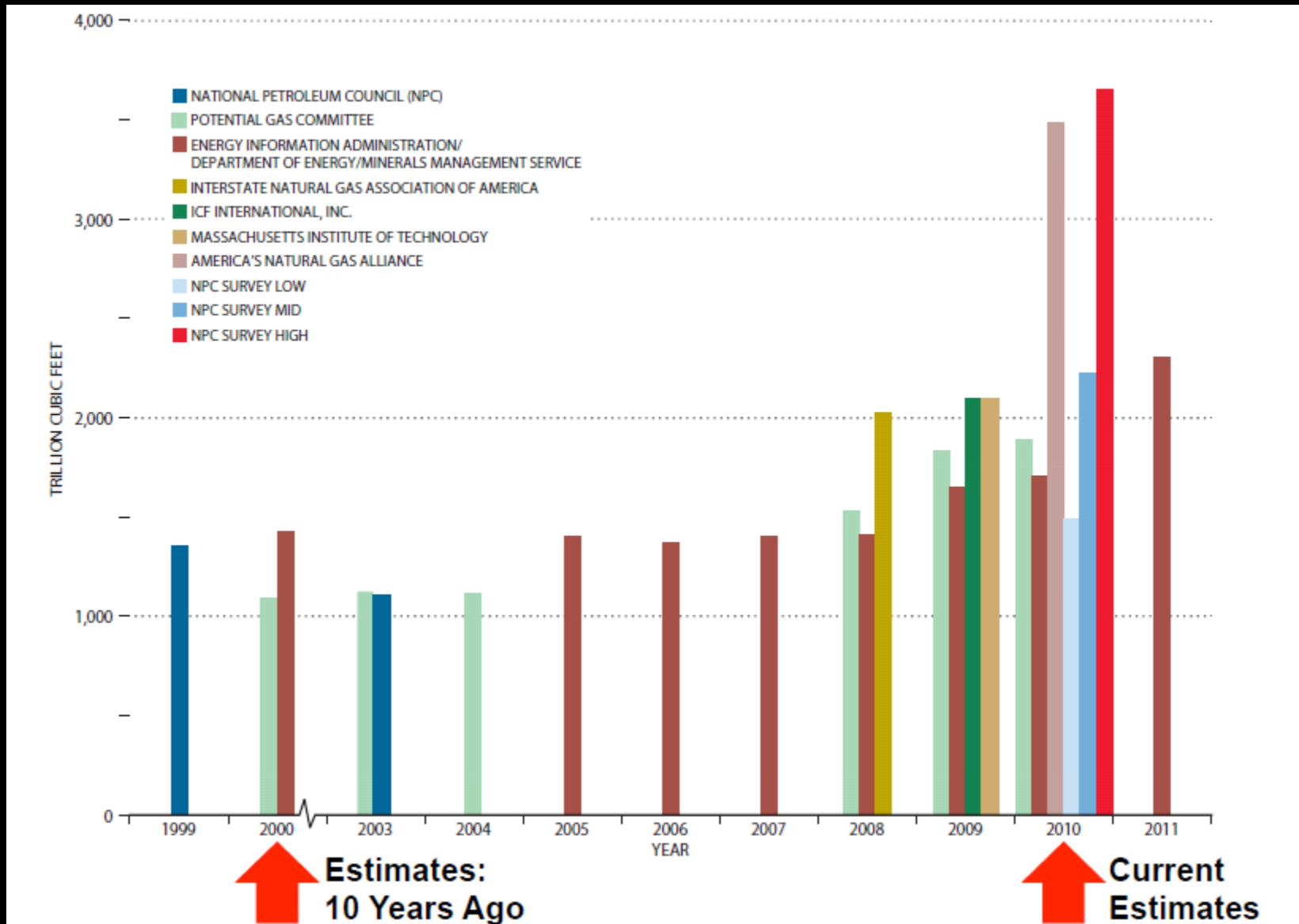
# As a result conventional discoveries continue to lag demand



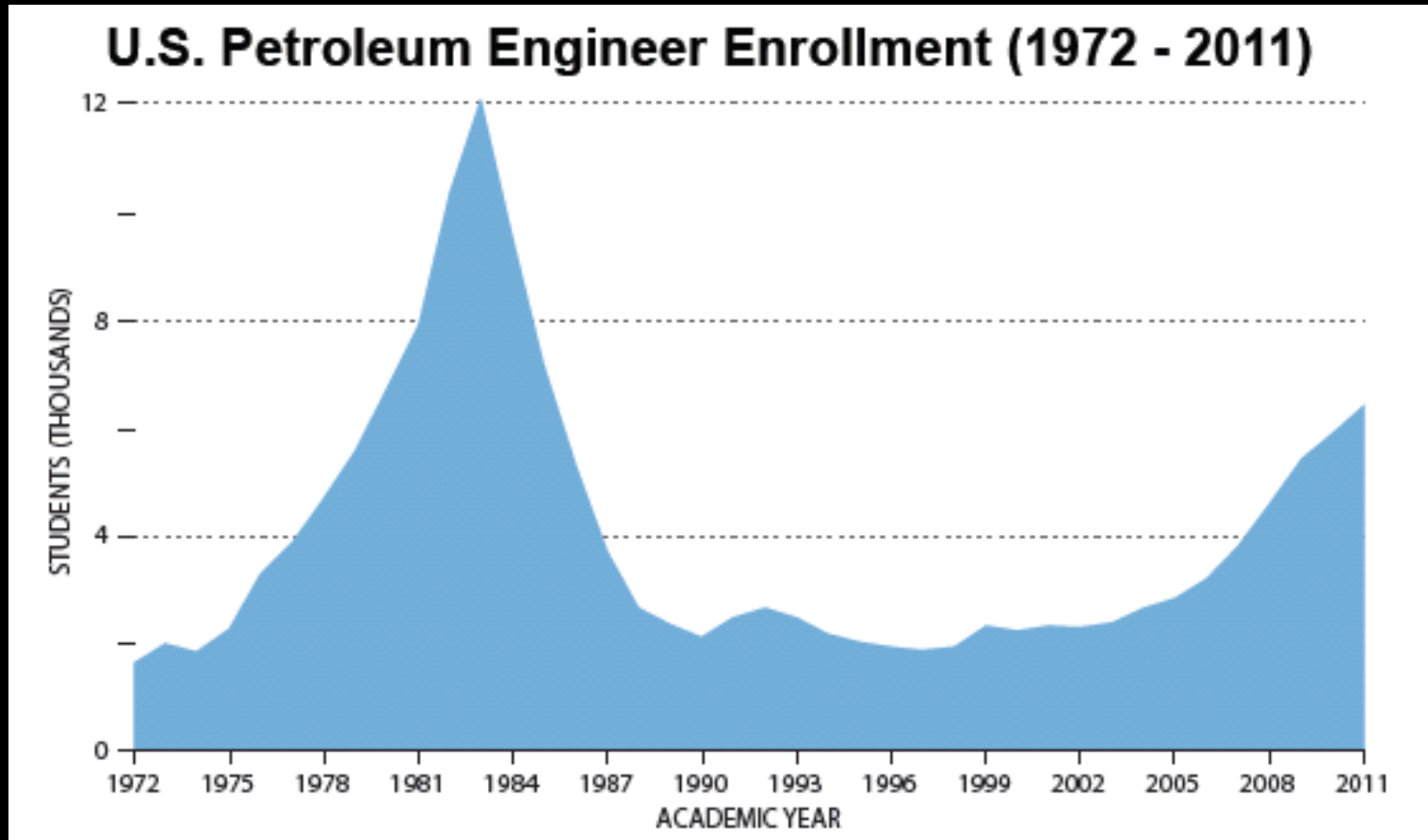
## Unconventionals - What has changed?

The use of horizontal drilling in conjunction with hydraulic fracturing has increased the industries ability to profitably produce natural gas, liquids and oil from low permeability geologic formations, particularly shale formations

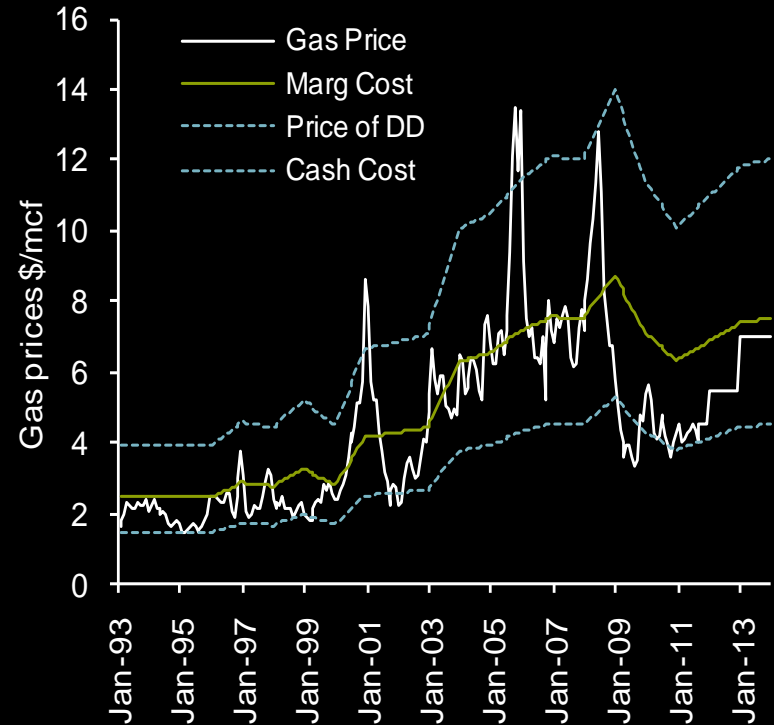
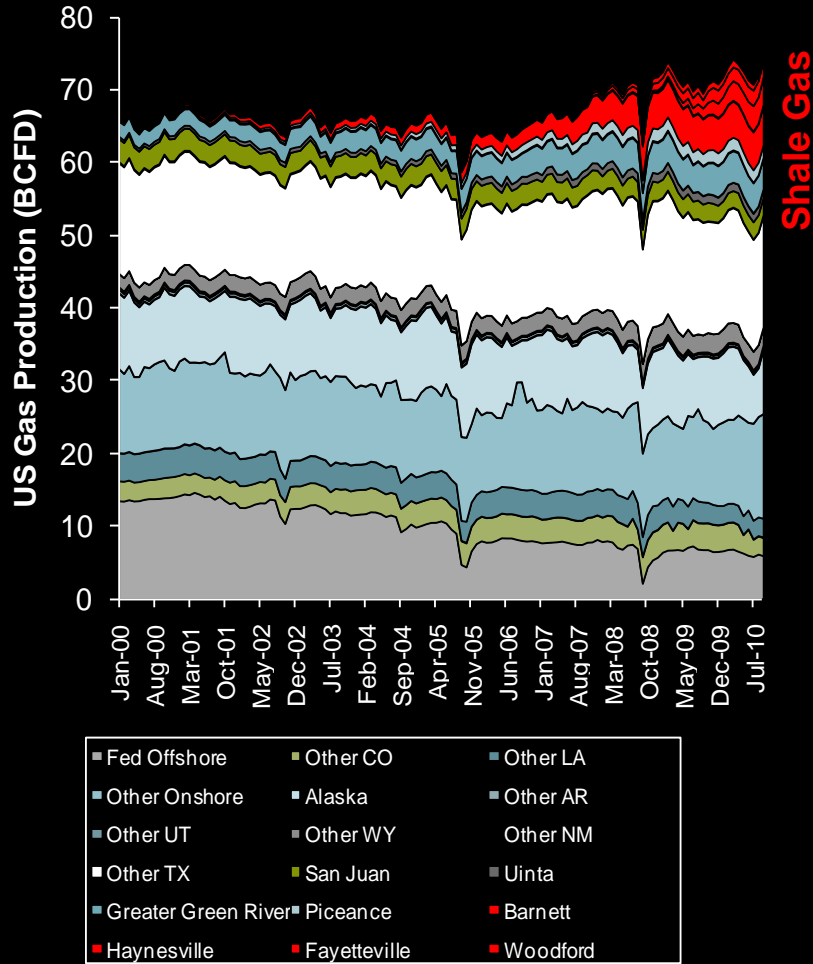
# Leading to a doubling of North American gas resources over the last 10 years



# And boosting the attraction of the industry as a career



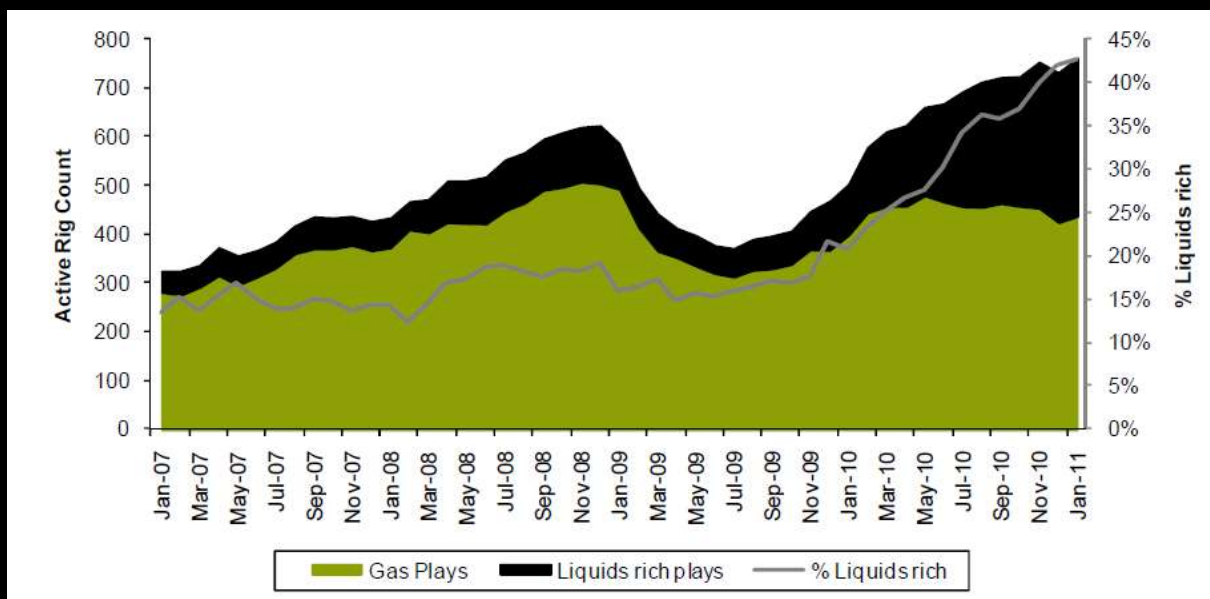
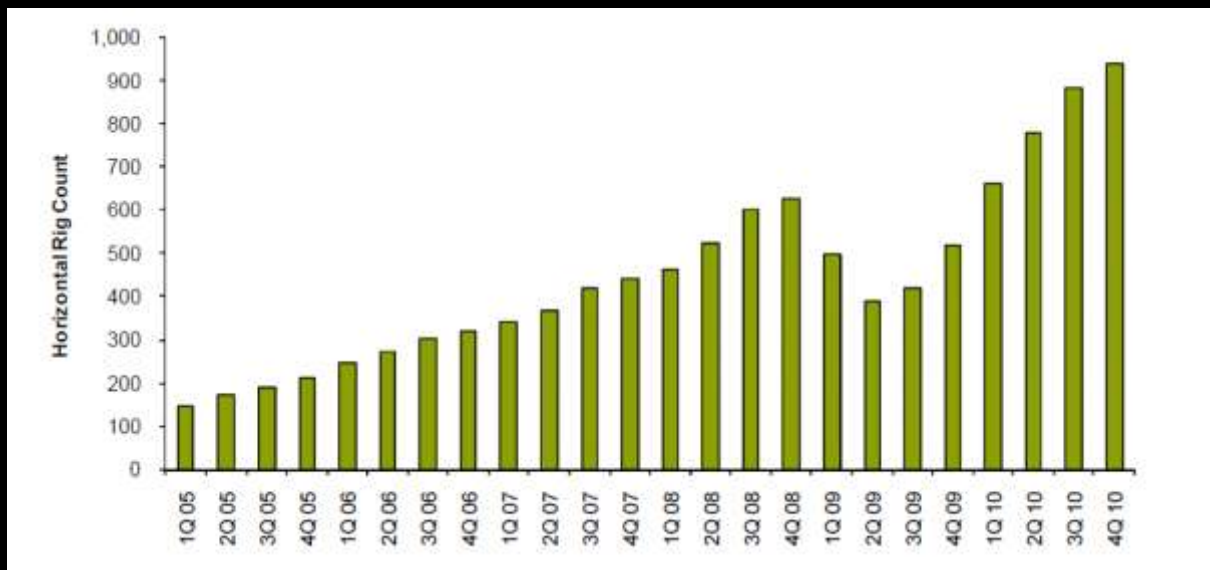
# The US Shale Gas Revolution



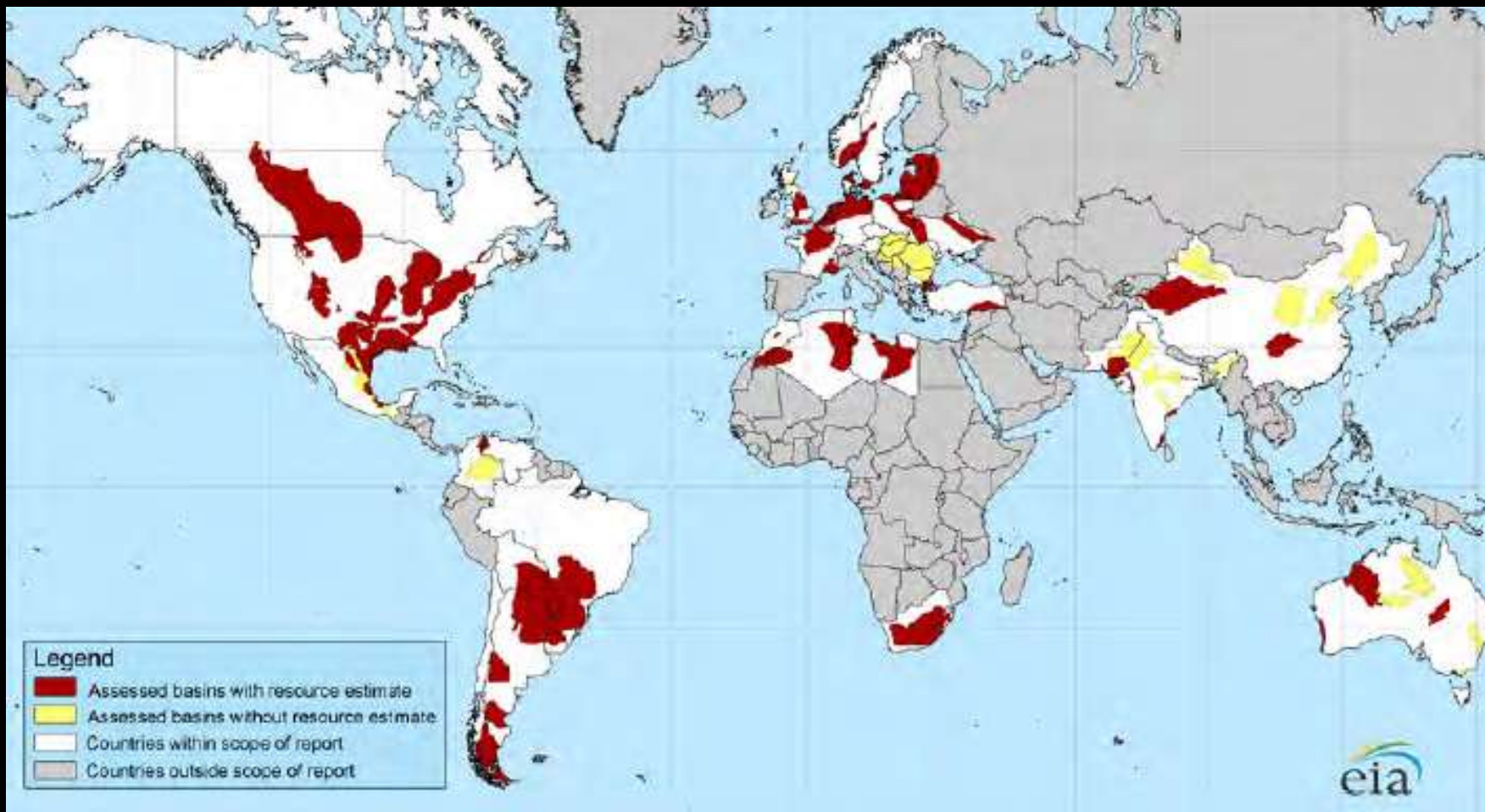
Source: HPDI, EIA, Bloomberg LP, and Bernstein estimates



# While gas prices have been impacted, activity levels are now simply shifting to the liquids and oil plays



# Can the US success be repeated globally



Source: EIA

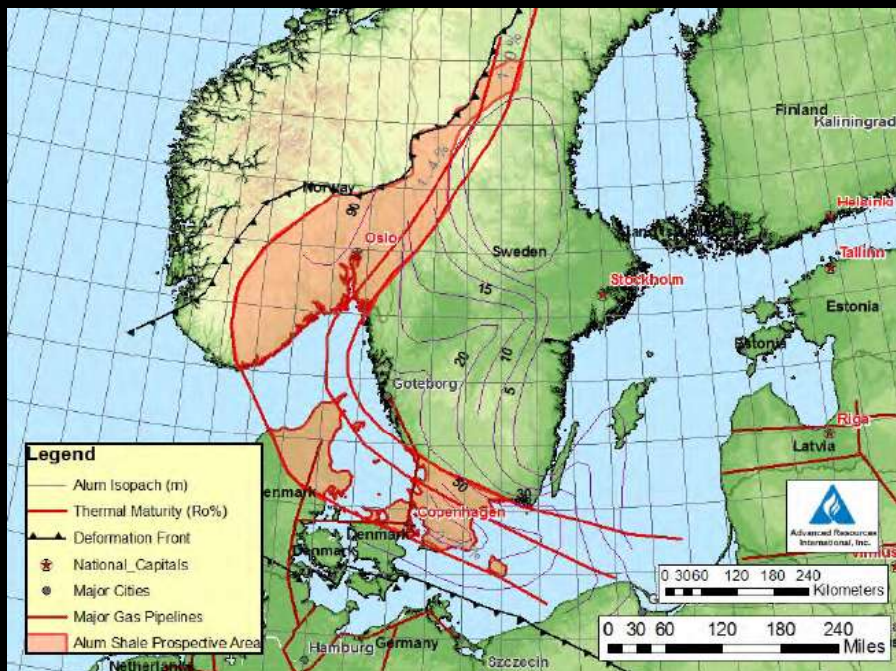
# Significant gas resource estimates have been proposed

	2009 Natural Gas Market <sup>(1)</sup> (trillion cubic feet, dry basis)			Proved Natural Gas Reserves <sup>(2)</sup> (trillion cubic feet)	Technically Recoverable Shale Gas Resources (trillion cubic feet)
	Production	Consumption	Imports (Exports)		
<b>Europe</b>					
France	0.03	1.73	98%	0.2	180
Germany	0.51	3.27	84%	6.2	8
Netherlands	2.79	1.72	(62%)	49.0	17
Norway	3.65	0.16	(2,156%)	72.0	83
U.K.	2.09	3.11	33%	9.0	20
Denmark	0.30	0.16	(91%)	2.1	23
Sweden	-	0.04	100%	-	41
Poland	0.21	0.58	84%	5.9	187
Turkey	0.03	1.24	98%	0.2	15
Ukraine	0.72	1.56	54%	39.0	42
Lithuania	-	0.10	100%	-	4
Others <sup>(3)</sup>	0.48	0.95	50%	2.71	19
<b>North America</b>					
United States <sup>(4)</sup>	20.6	22.8	10%	272.5	862
Canada	5.63	3.01	(87%)	62.0	388
Mexico	1.77	2.15	18%	12.0	681
<b>Asia</b>					
China	2.93	3.08	5%	107.0	1,275
India	1.43	1.87	24%	37.9	63
Pakistan	1.36	1.36	-	29.7	51
<b>Australia</b>	1.67	1.09	(52%)	110.0	396
<b>Africa</b>					
South Africa	0.07	0.19	63%	-	485
Libya	0.56	0.21	(165%)	54.7	290
Tunisia	0.13	0.17	26%	2.3	18
Algeria	2.88	1.02	(183%)	159.0	231
Morocco	0.00	0.02	90%	0.1	11
Western Sahara	-	-	-	-	7
Mauritania	-	-	-	1.0	0
<b>South America</b>					
Venezuela	0.65	0.71	9%	178.9	11
Colombia	0.37	0.31	(21%)	4.0	19
Argentina	1.46	1.52	4%	13.4	774
Brazil	0.36	0.66	45%	12.9	226
Chile	0.05	0.10	52%	3.5	64
Uruguay	-	0.00	100%	-	21
Paraguay	-	-	-	-	62
Bolivia	0.45	0.10	(346%)	26.5	48
<b>Total of above areas</b>	<b>53.1</b>	<b>55.0</b>	<b>(3%)</b>	<b>1,274</b>	<b>6,622</b>
<b>Total world</b>	<b>106.5</b>	<b>106.7</b>	<b>0%</b>	<b>6,609</b>	

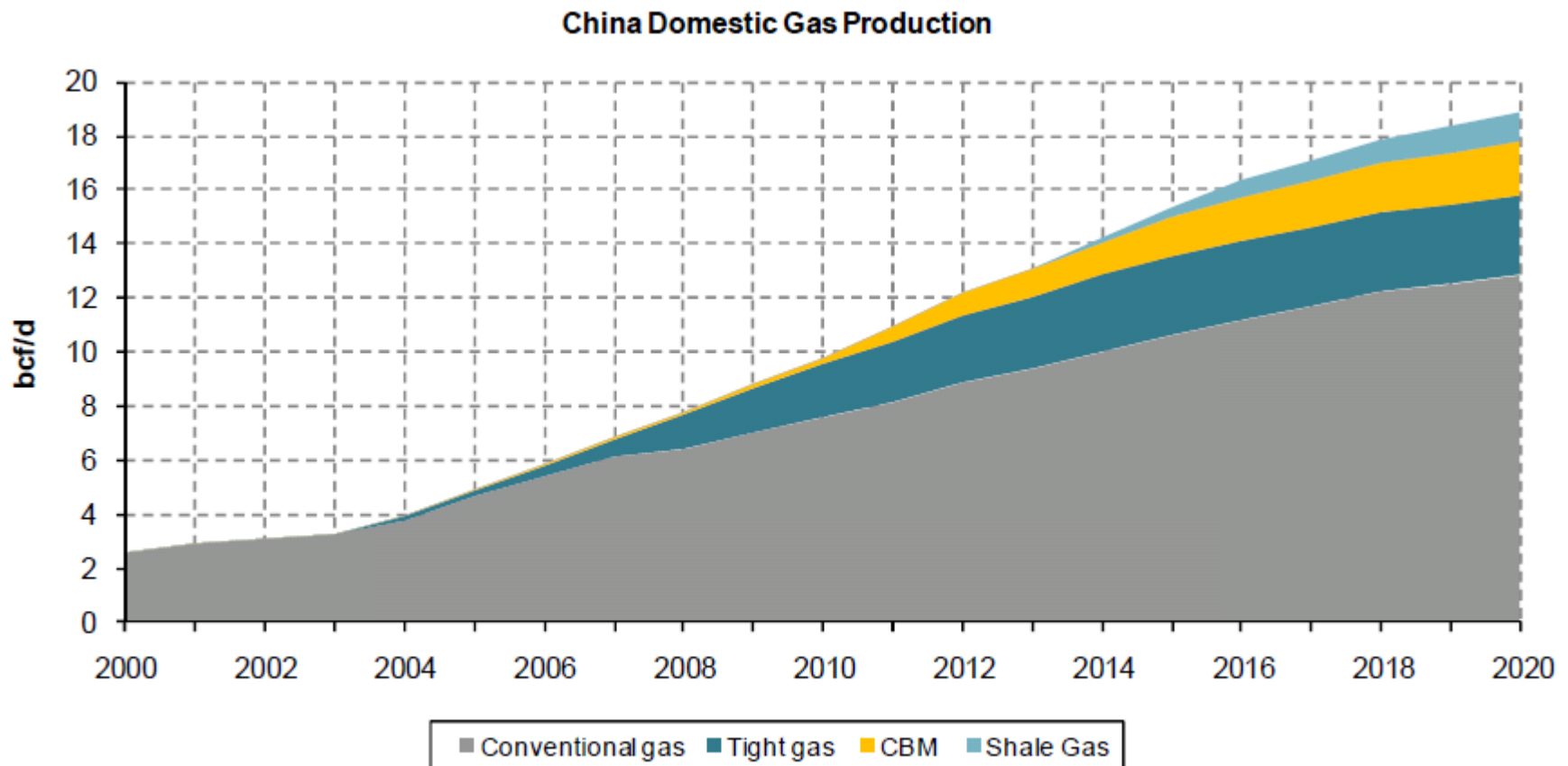
Global Proven Gas Reserves = 6609 Tcf

Recoverable Shale Gas Resources = 6622 Tcf

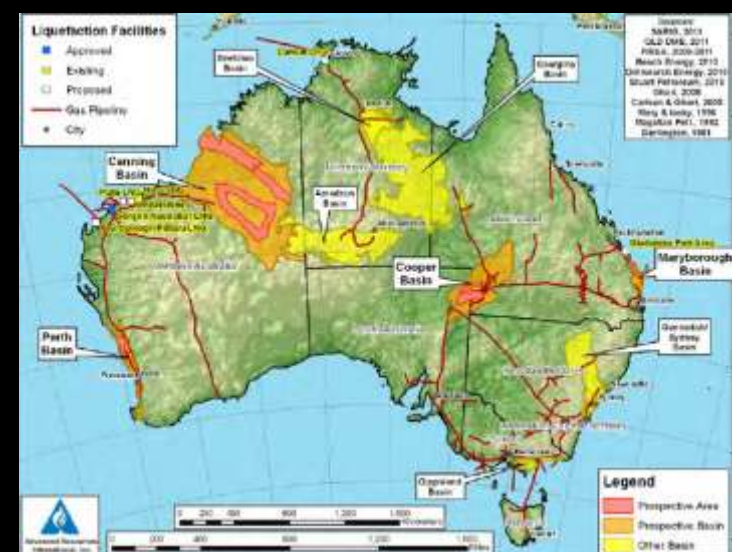
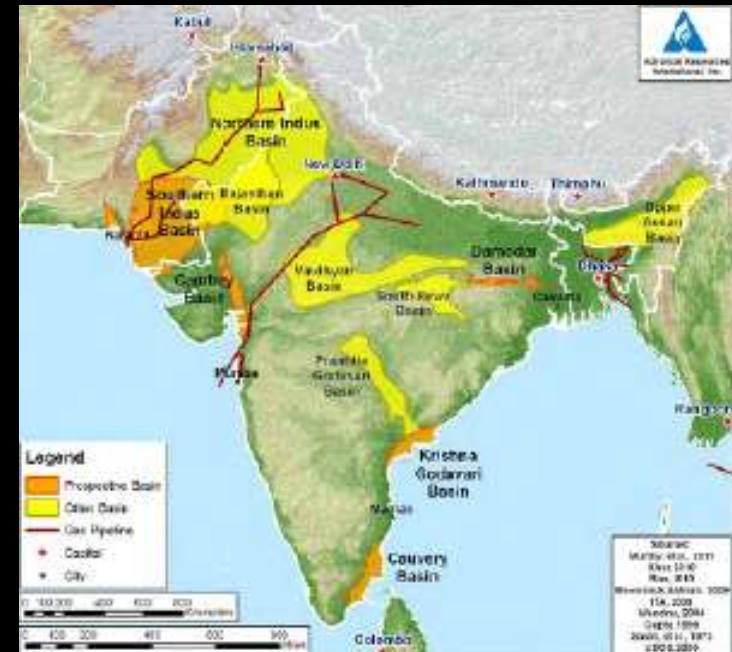
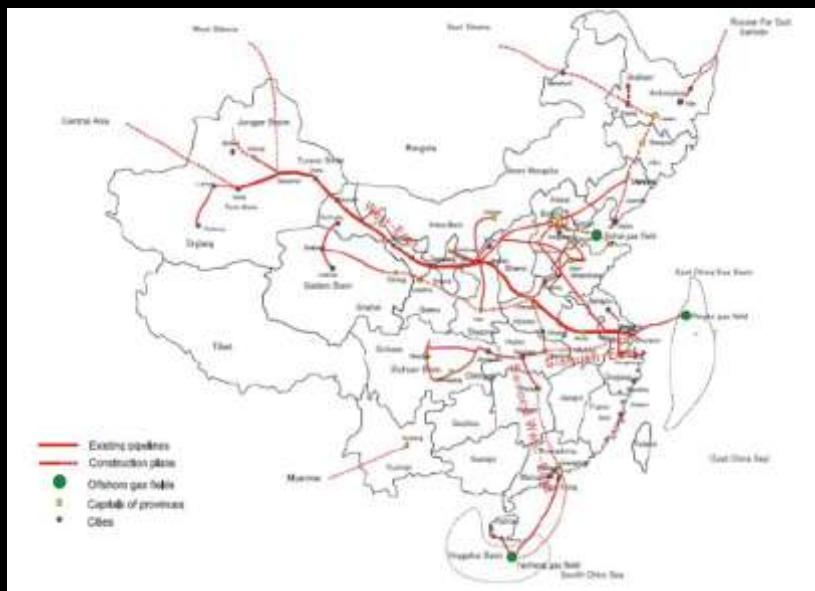
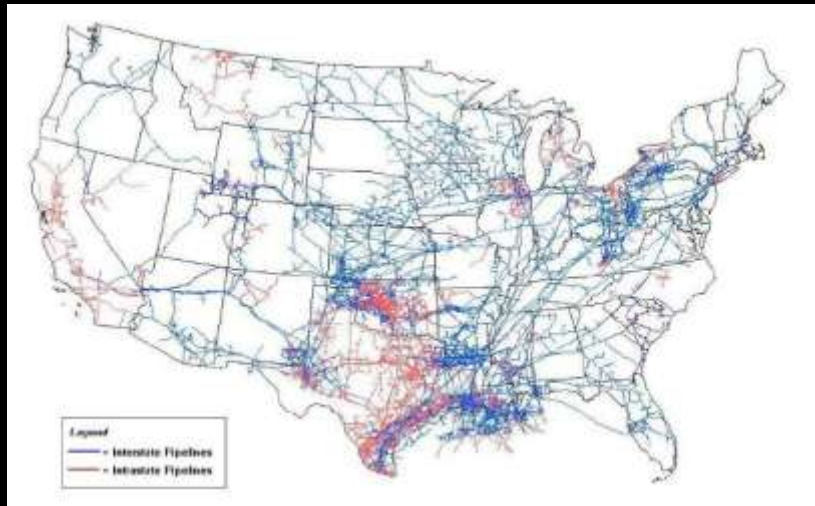
# But not all shale's are giving the optimum commercial results...Scandinavia's Alum Shale is a question mark



# China has the largest estimated shale gas reserves but we think shale will be only 2% of total production by 2020

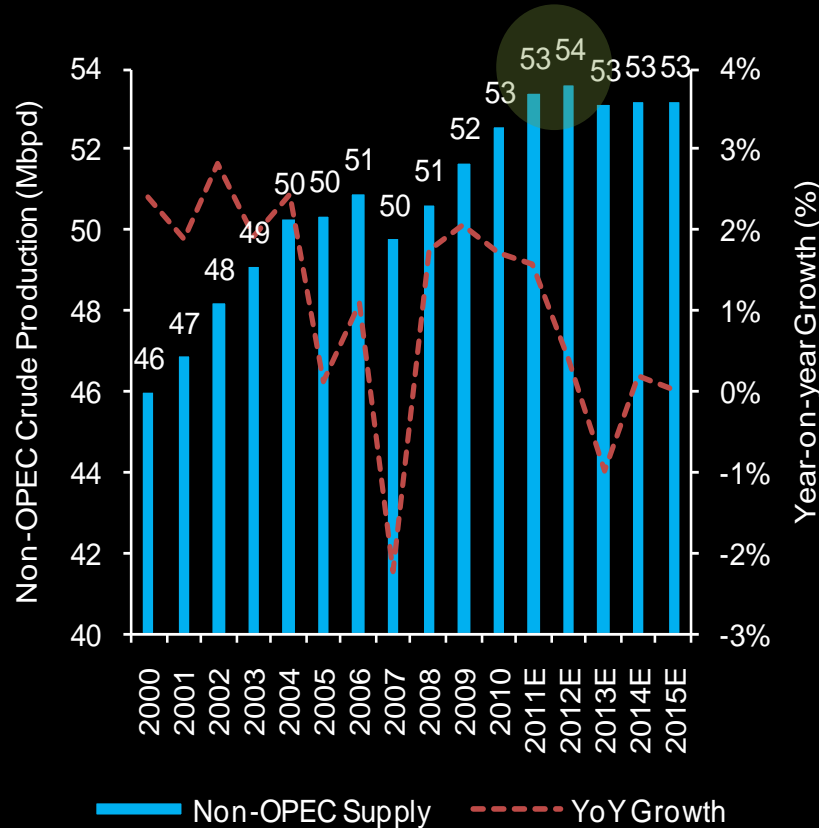


# For China and other countries, infrastructure remains a major impediment to repeating the US success case

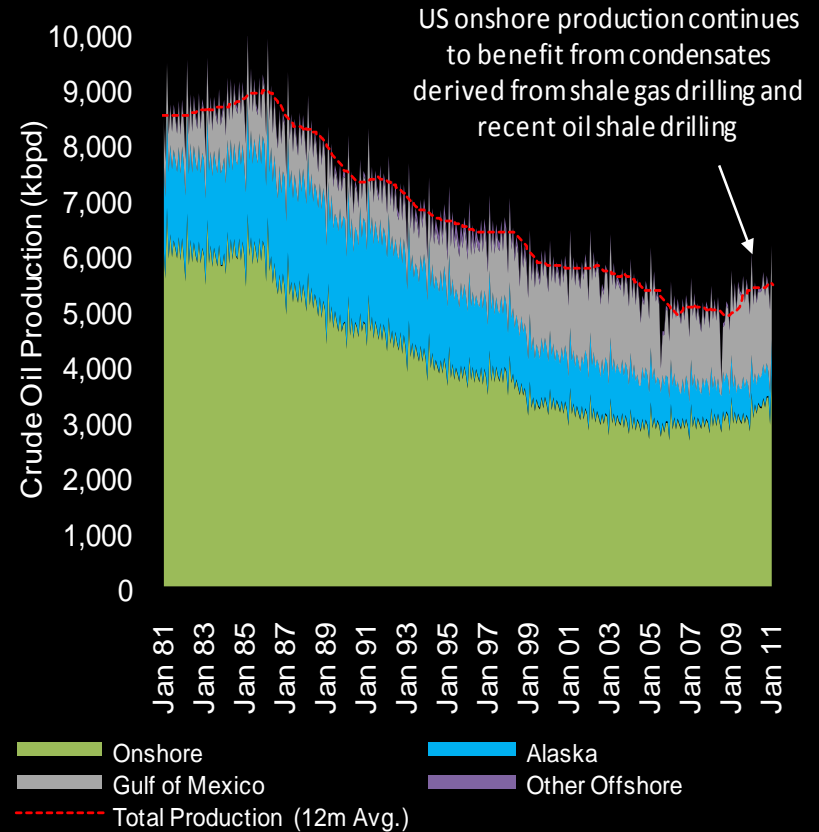


# Now the focus is on oil shale – already non-OPEC oil production has been rising with US liquids as one reason

## Non-OPEC Crude Oil Supply



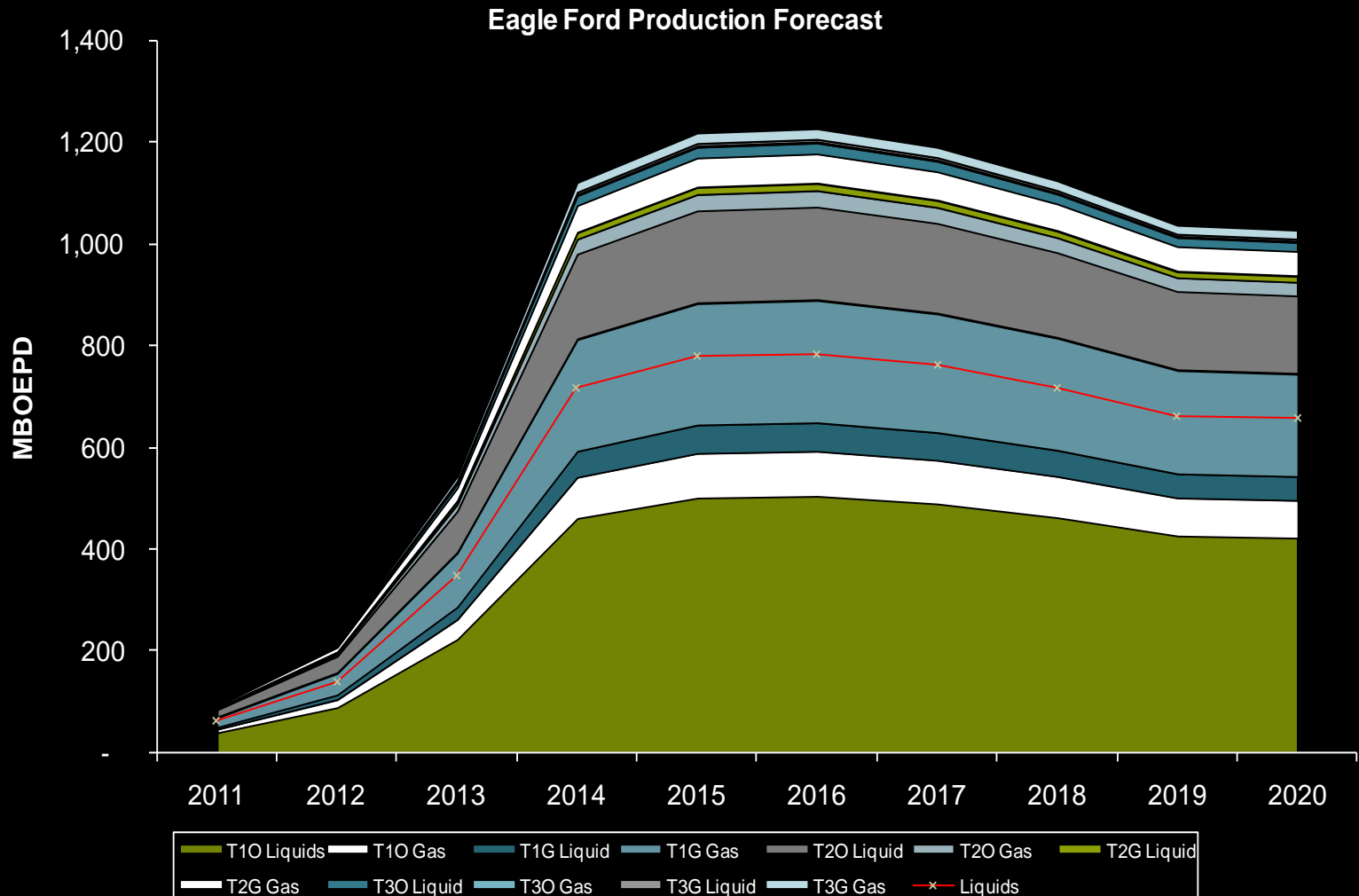
## US Crude Oil Production



Source: IEA. Bernstein estimates

Source: Bloomberg, Bernstein analysis

# We expect 1-1.2 million barrels of oil equivalent production by 2015



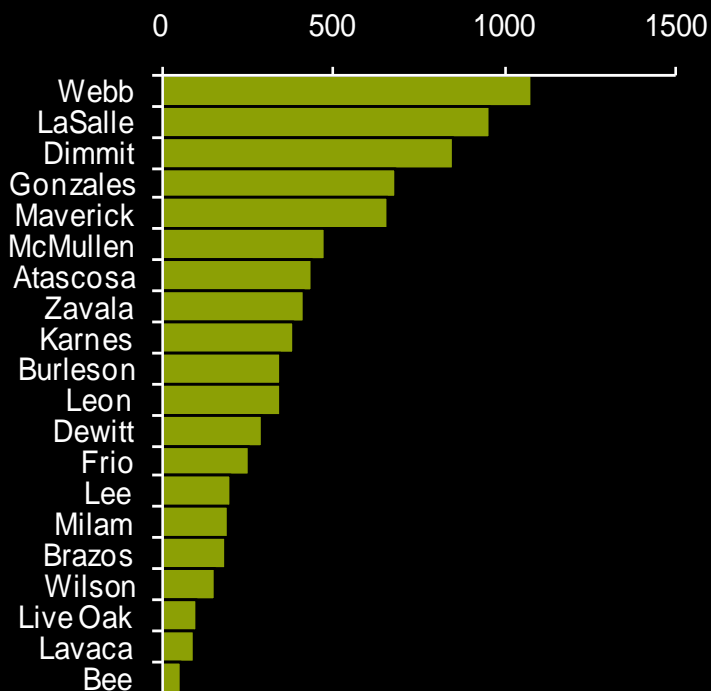
Source: HPDI, Bernstein estimates



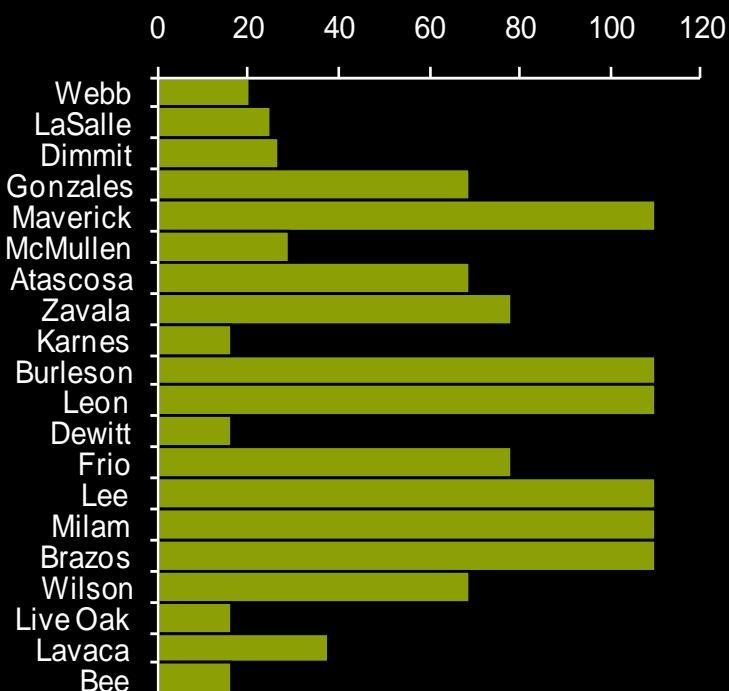
# However the economics of shale liquids vary from great to poor

## Eagle Ford Shale Estimated Extent and Economics by County

Eagle Ford Prospective Acreage by County (thousand acres)



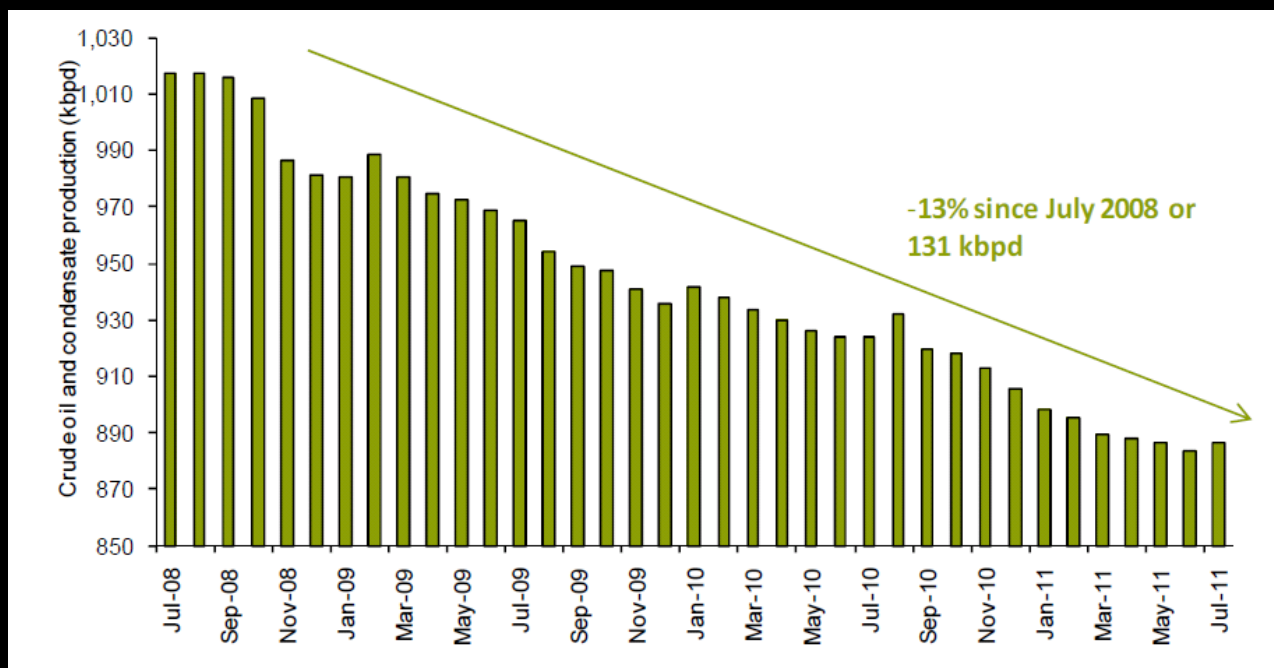
Average Eagle Ford F&D by County (\$/bbl)



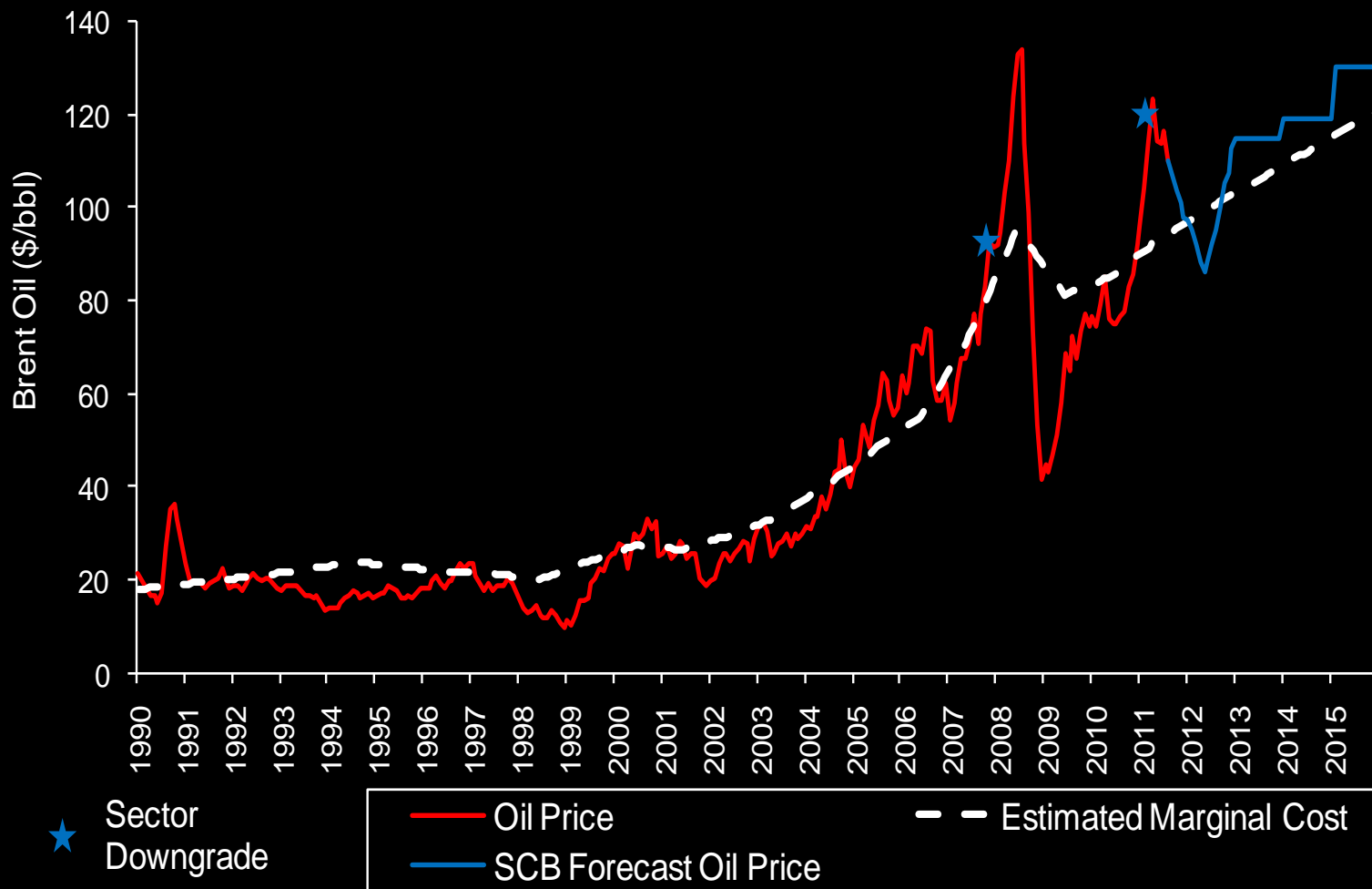
Source: HPDI, Bernstein analysis

# Russian companies are now talking about drilling more horizontal wells and then testing the Bashenov oil shale

Scenario 3 - Stabilize and grow	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lukoil Oil Production - Target (Mbbls)	658	634	621	612	622	632	642	652	663	673	684	695
		-3.6%	-2.0%	-1.5%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Status Quo - Base declining at 5% (Mbbls)	-	625	594	564	536	509	484	460	437	415	394	374
Delta (Mbbls)	-	9	27	48	86	123	158	193	226	258	290	321
Number of horizontal wells required	-	62	192	335	600	857	1,106	1,347	1,581	1,808	2,028	2,242
Run rate of 2010 horizontal wells	101	101	101	101	101	101	101	101	101	101	101	101
Aggregate wells required	101	163	293	436	701	958	1,207	1,448	1,682	1,909	2,129	2,343
Estimated number of rigs	101	163	293	436	701	958	1,207	1,448	1,682	1,909	2,129	2,343
Estimated costs (\$M)		326	615	960	1,624	2,330	3,081	3,881	4,733	5,640	6,606	7,634



# We don't yet think there is enough unconventional liquids coming through to impact our view of rising oil prices



# Summary

## ■ US Shale Gas is Clear Success Case

- Shale Gas – added 6 BCFD into ~flat 66 BCFD market (10%)
- Pushed prices to cash costs but multiple demand sectors and ability to drive competing fuels out (coal from power generation) will increase demand. Falling drilling activity will also reduce supply and prices can recover.

## ■ Size of Market Protects Oil Price

- Shale Liquids – US may add 2Mbpd into a growing global 90Mbpd market (2%)
- Demand from one only market (transport), so no additional markets to attract further growth

## ■ Structure of Market Protects Prices

- Shale Gas – prices driven by competition between producers
- Shale Liquids – prices supported by OPEC cartel

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