



Shale Gas Plays: Development, Economics, and the Future

University of Texas

Center for Energy Economics

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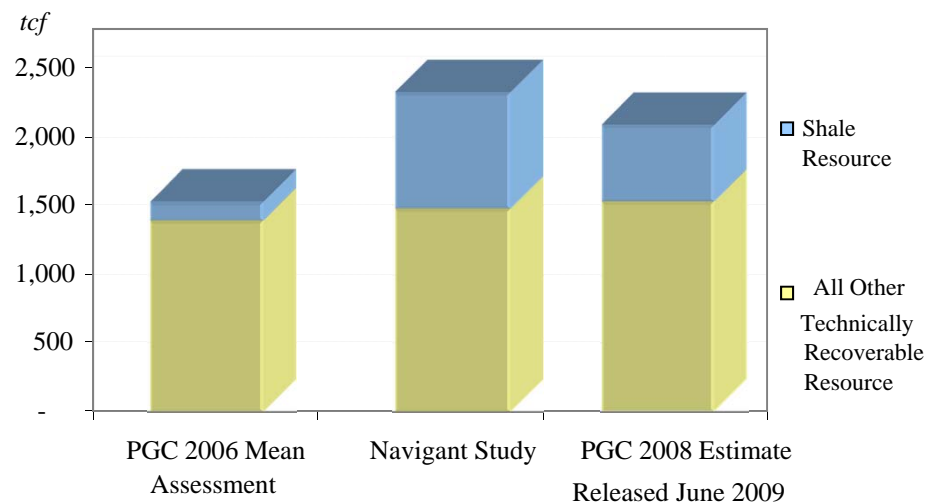
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Yes, There Is a Lot of Gas Resource: The Recognition Started with the American Clean Skies Foundation

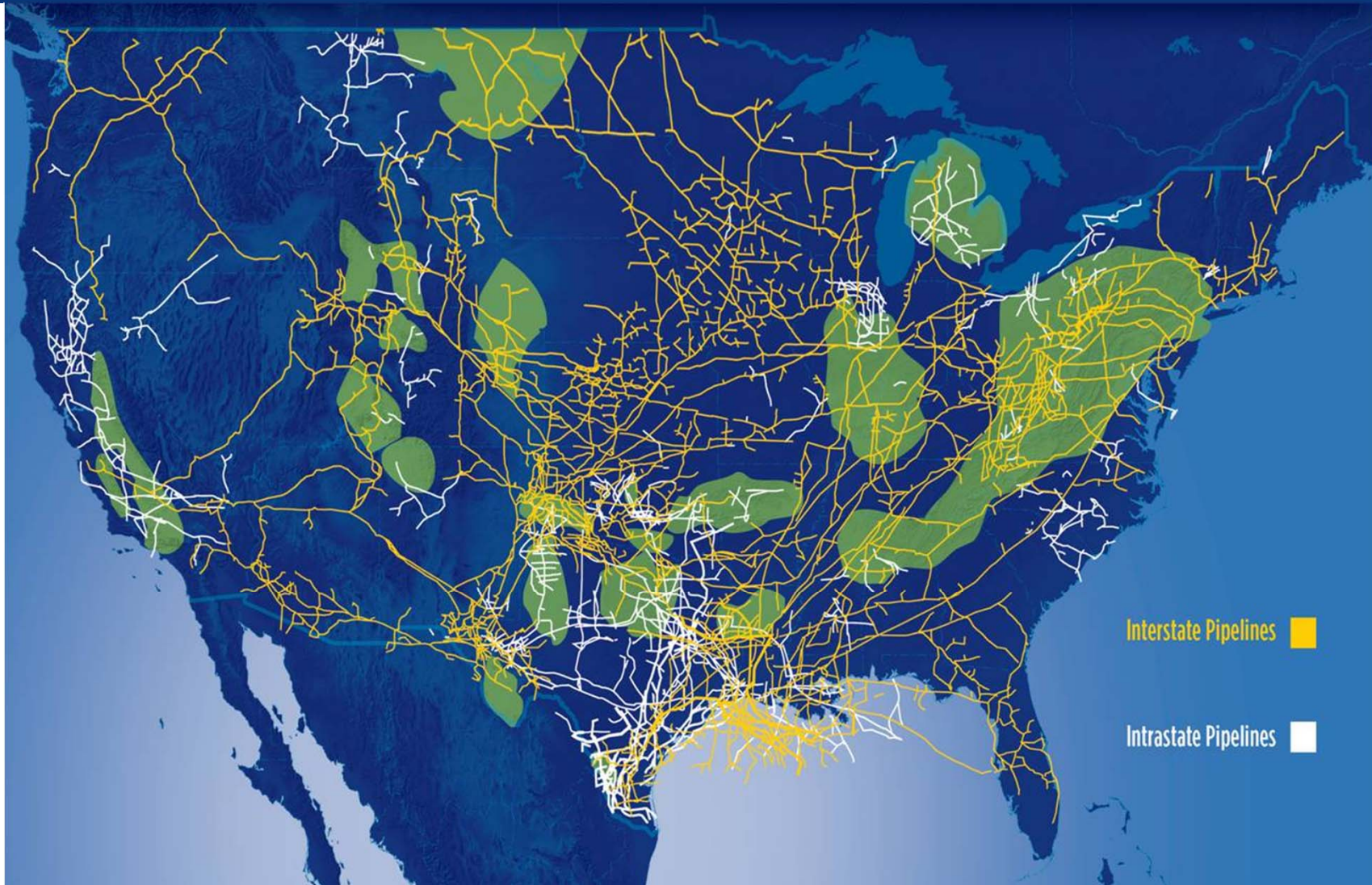
Proved Reserves Plus Assessed Resources—Life of the Gas Resource

- In 2006, the Potential Gas Committee (PGC) estimated 1,530 Tcf of total Recoverable Resource.
- In 2008, the **American Clean Skies Foundation** had Navigant perform the North American Natural Gas Supply Assessment. This study found that shale and other unconventional supplies had increased the resource to as much as 2,247 Tcf, including 842 Tcf of shale gas.. This would be 118 years of production at 2007 levels.
- In June 2009, PGC issued its 2008 updated study—2,076 Tcf, including 616 Tcf of shale, also over 100 years' worth.

U.S. Total Gas Supply (Tcf)



U.S. Shale Gas Basins Align with the Nationwide Pipeline Grid



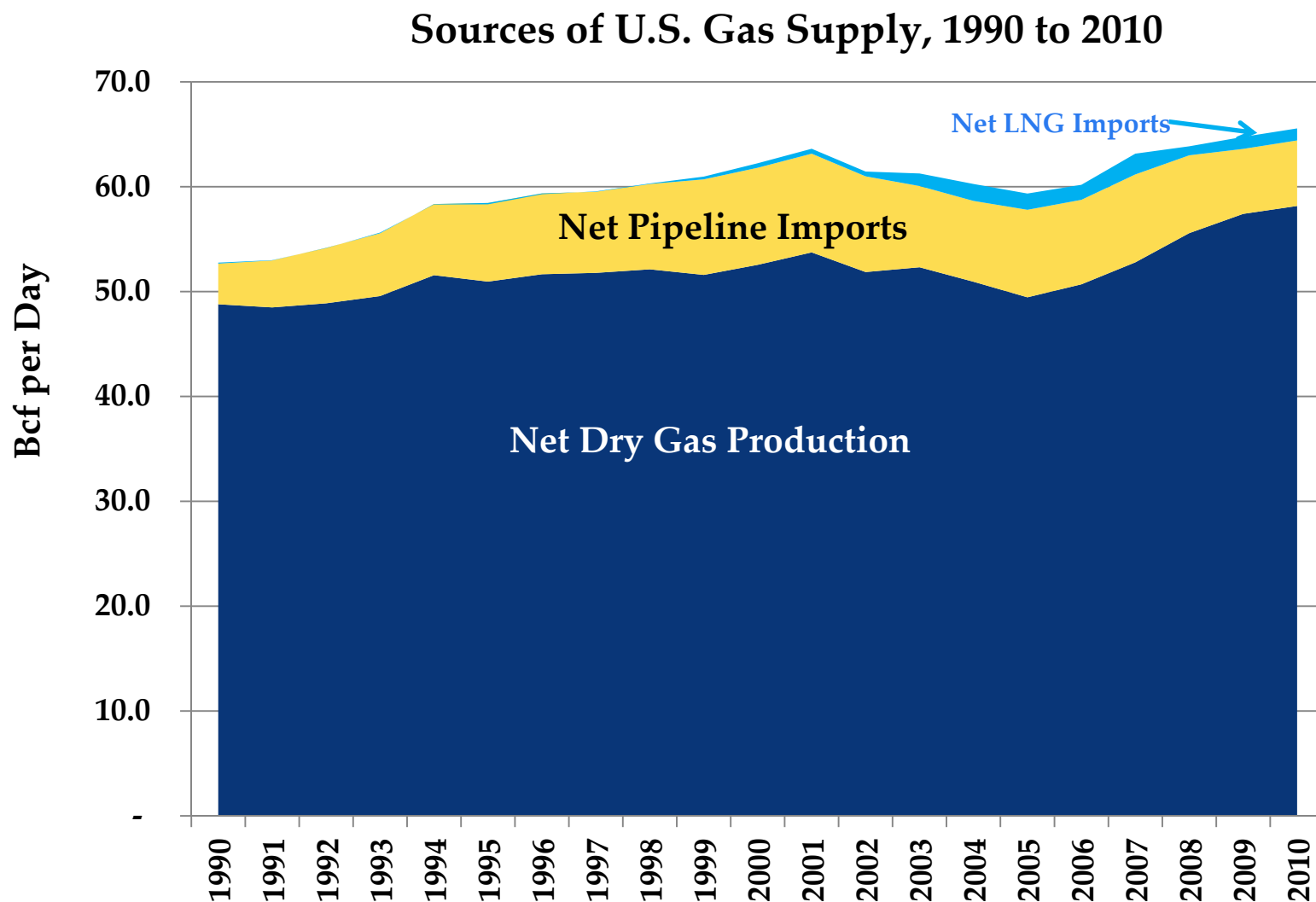
Sources: EIA, US Natural Gas Pipeline Network

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American Clean Skies Foundation

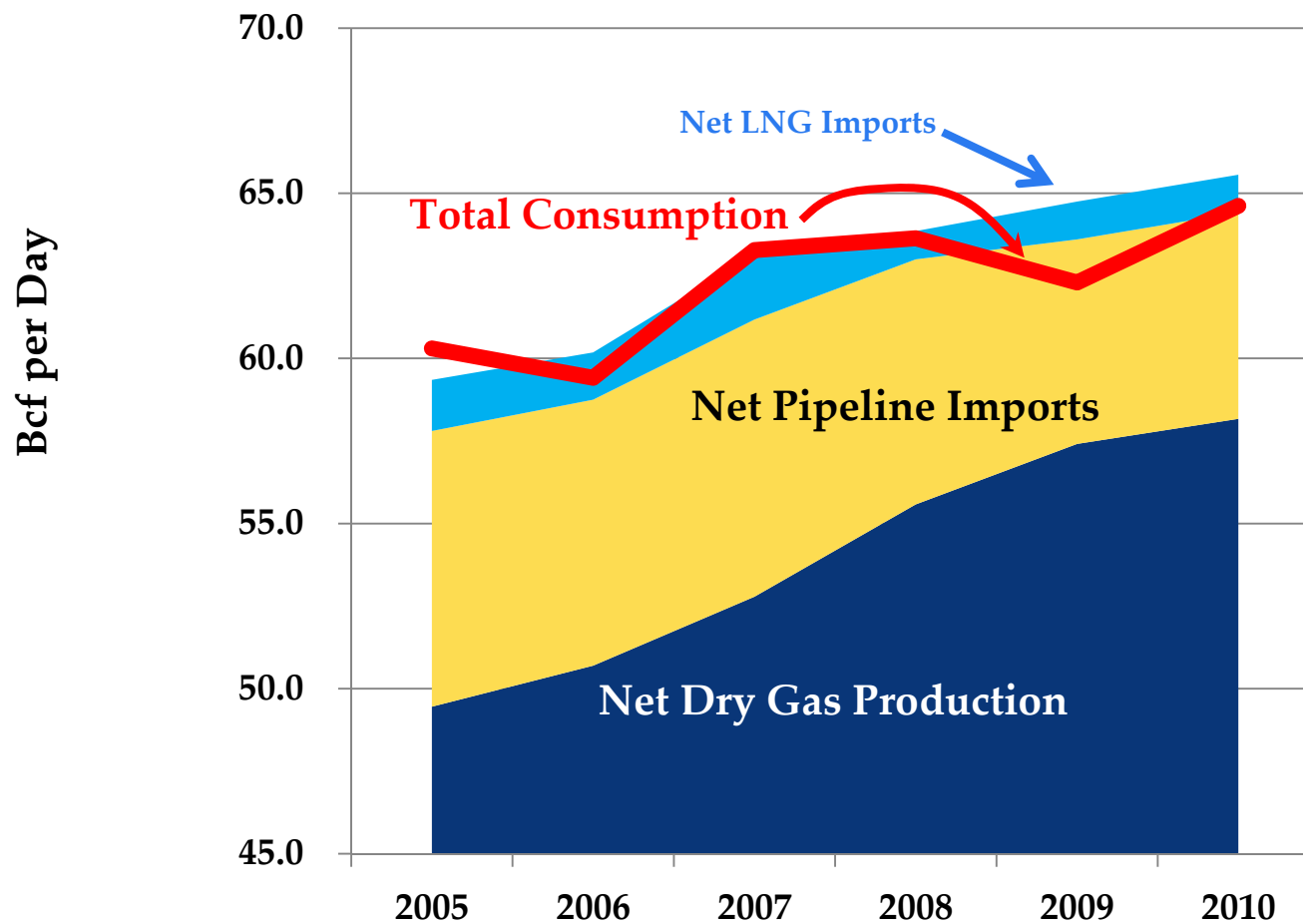
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**Total Gas Supply: For 15 years, Domestic Production was Flat,
with Growing Imports—**



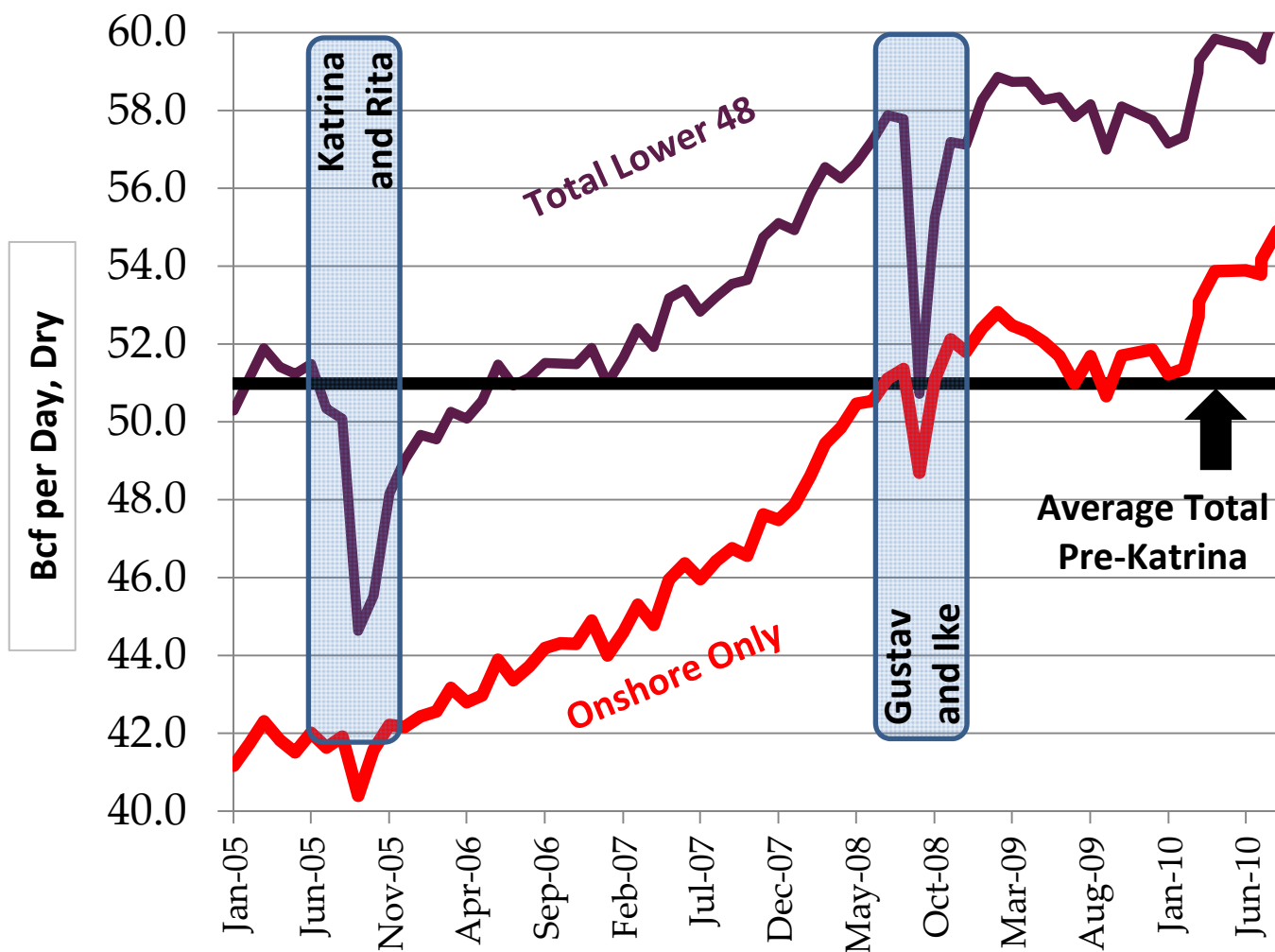
The Last Five Years Have Been Very Different—Thanks to Domestic Growth, Supply Now Exceeds Demand, and Imports are Shrinking

The Rapid Change from 2005



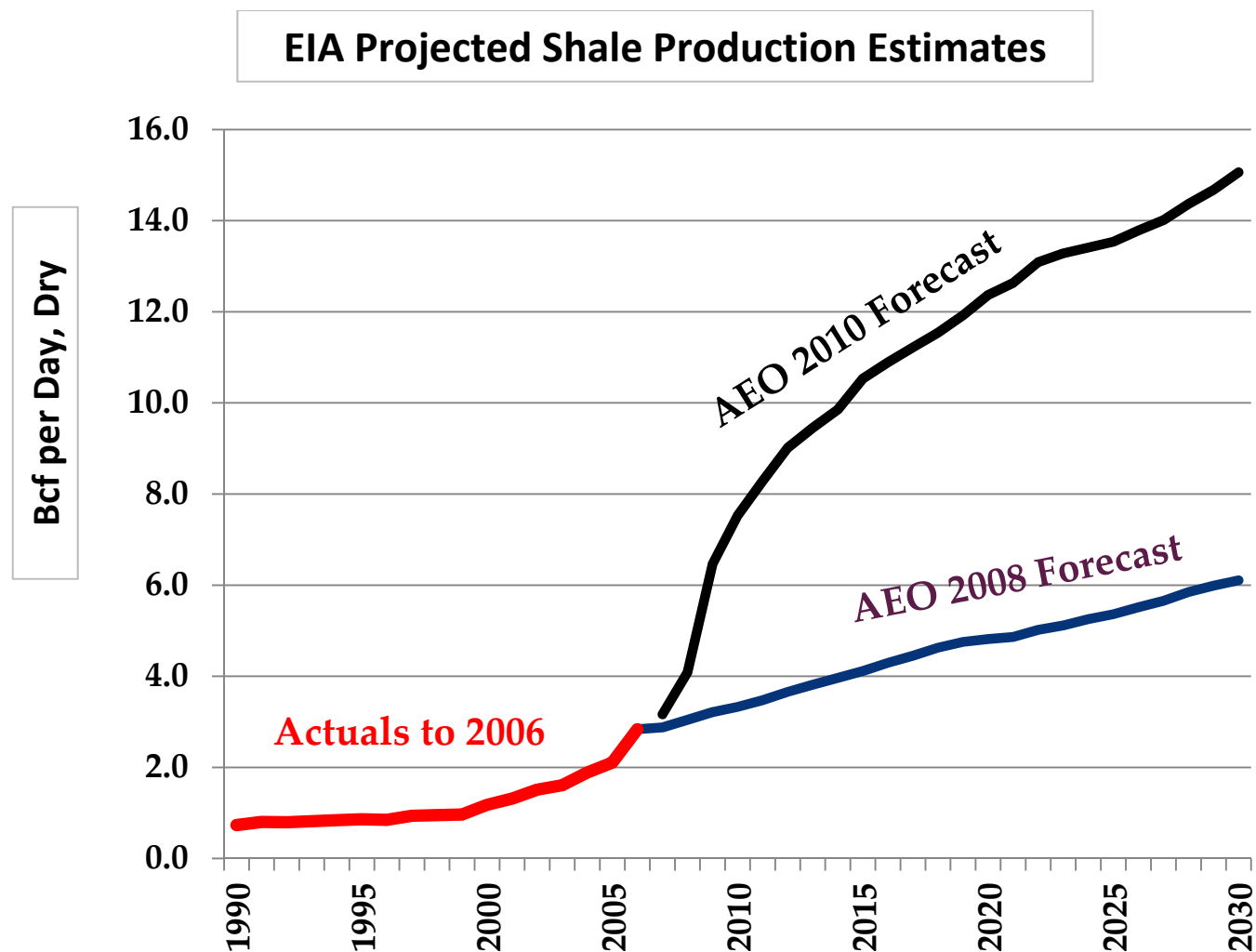
The Really Dramatic Story is Onshore, where Between 2005 and 2008, Enough Production Was Added to Replace Offshore

Lower 48 Production, Total and Onshore, 2005-2010

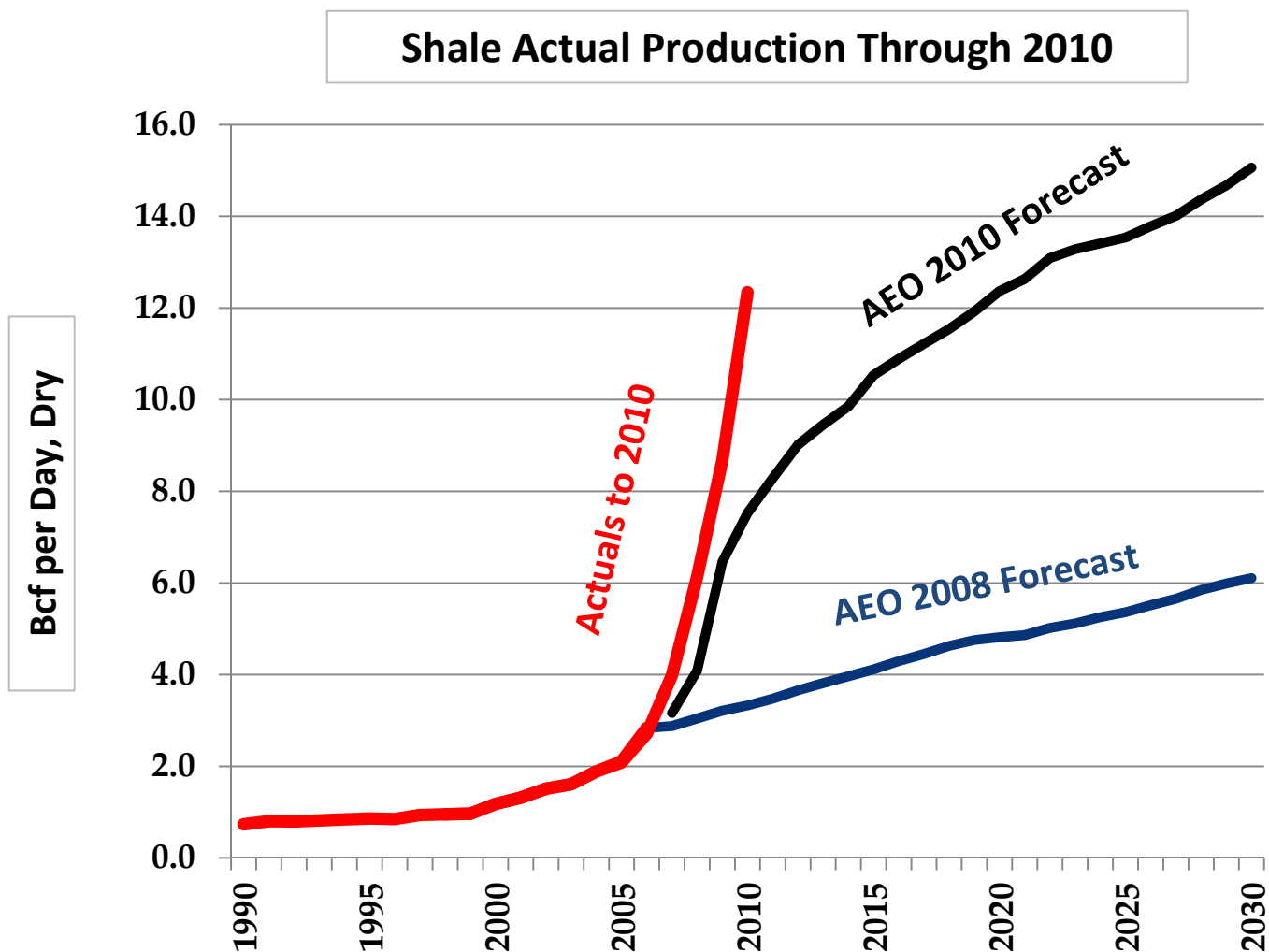


From 2005 to 2008, the daily energy added from onshore sources exceeds the thermal content of all the oil we import from Saudi Arabia.

What about Shale Gas? EIA Developed a Robust Forecast in 2010

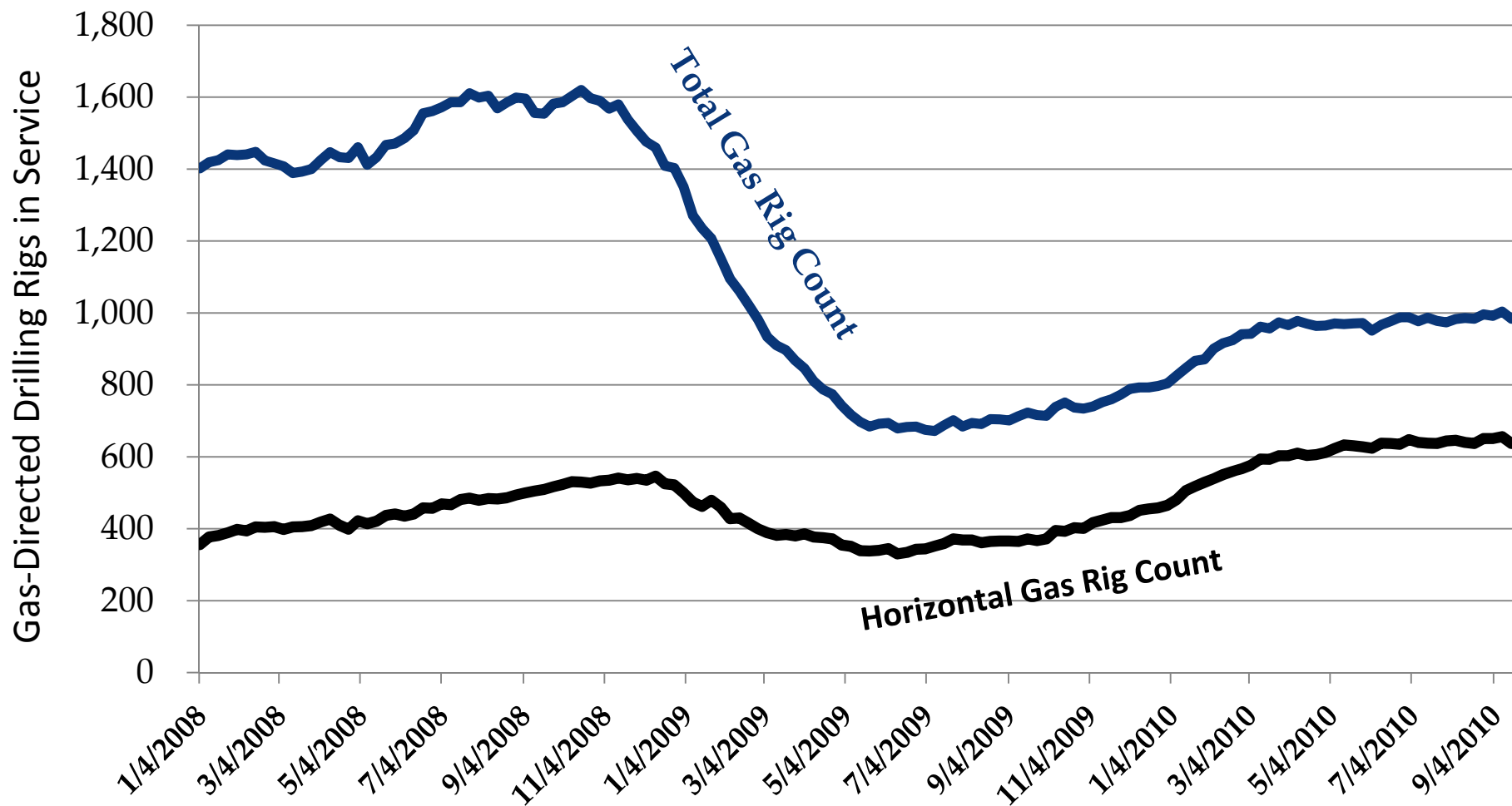


But Actual Production has Far Exceeded Even the Aggressive 2010 Forecast



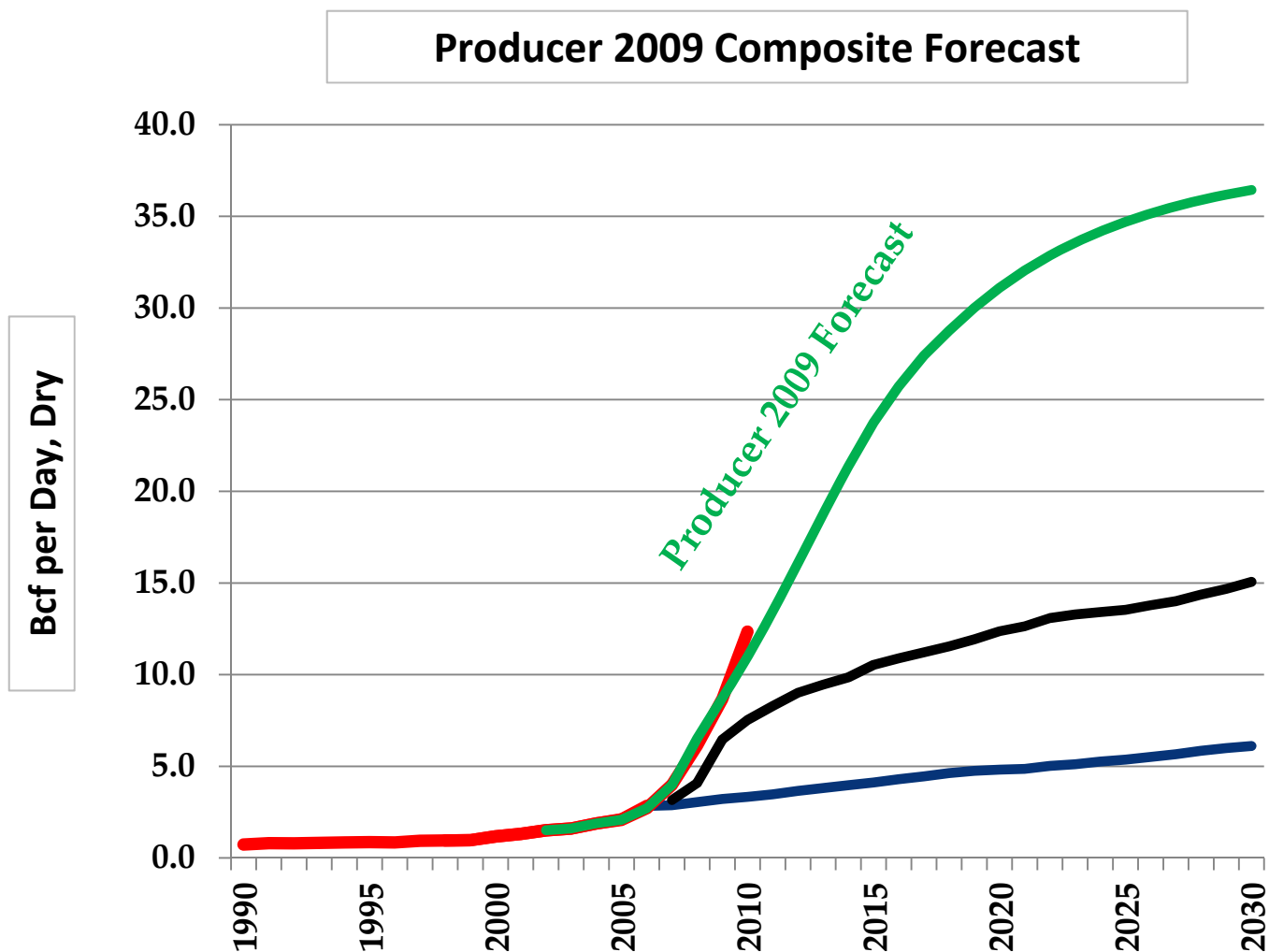
Why? Didn't drilling drop off a lot since 2008?

Yes, in total—but horizontal drilling is going strong...

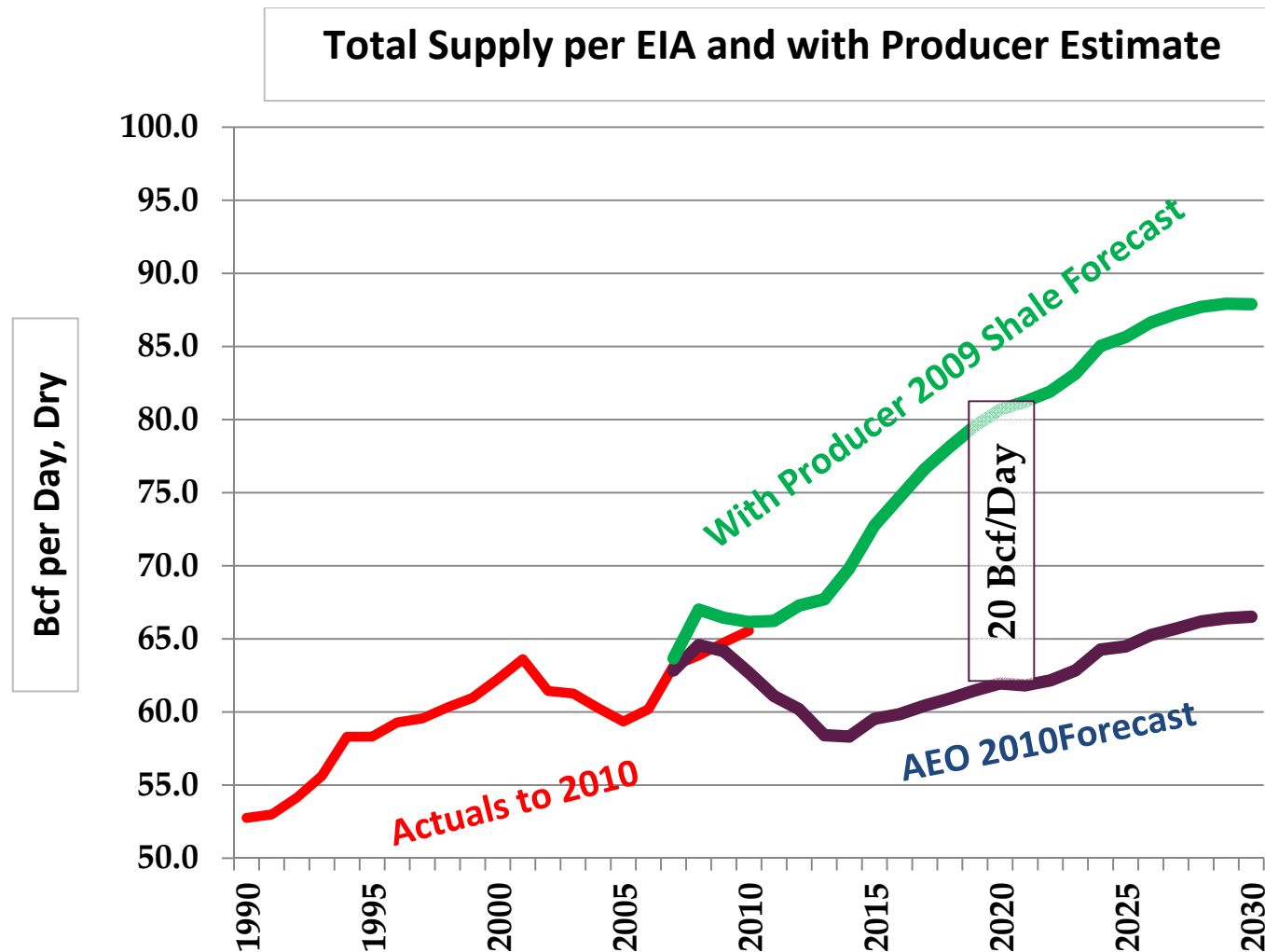


Source: Smith Bits

Producers Expect the Trend to Continue if There's a Demand for the Gas— 2010 Actuals Exceeded Even the Producers' 2009 Forecast

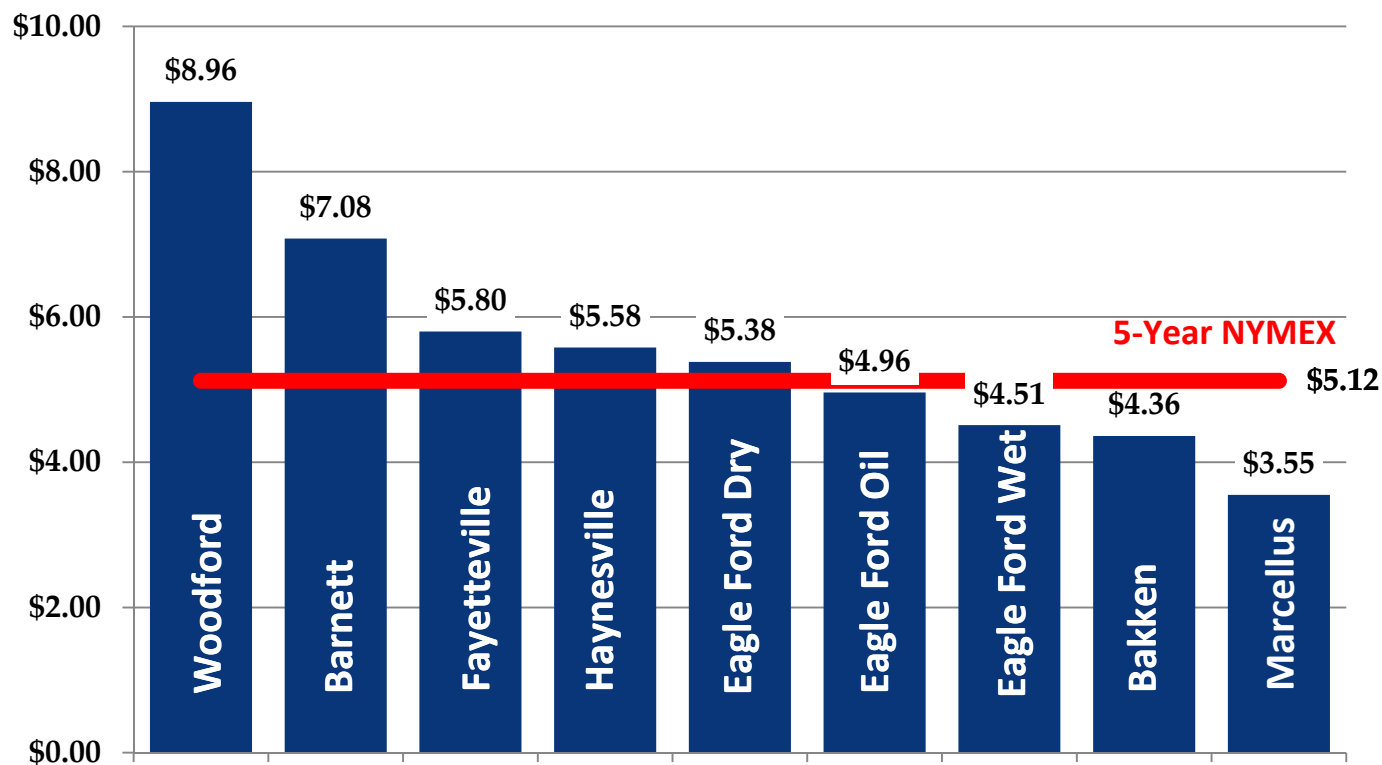


Based on that Producer Forecast, There Would Be Enough Additional Supply by 2020 to Displace Over Half of All U.S. Coal-Fired Generation



The Break-Even Price Varies a Lot by Play

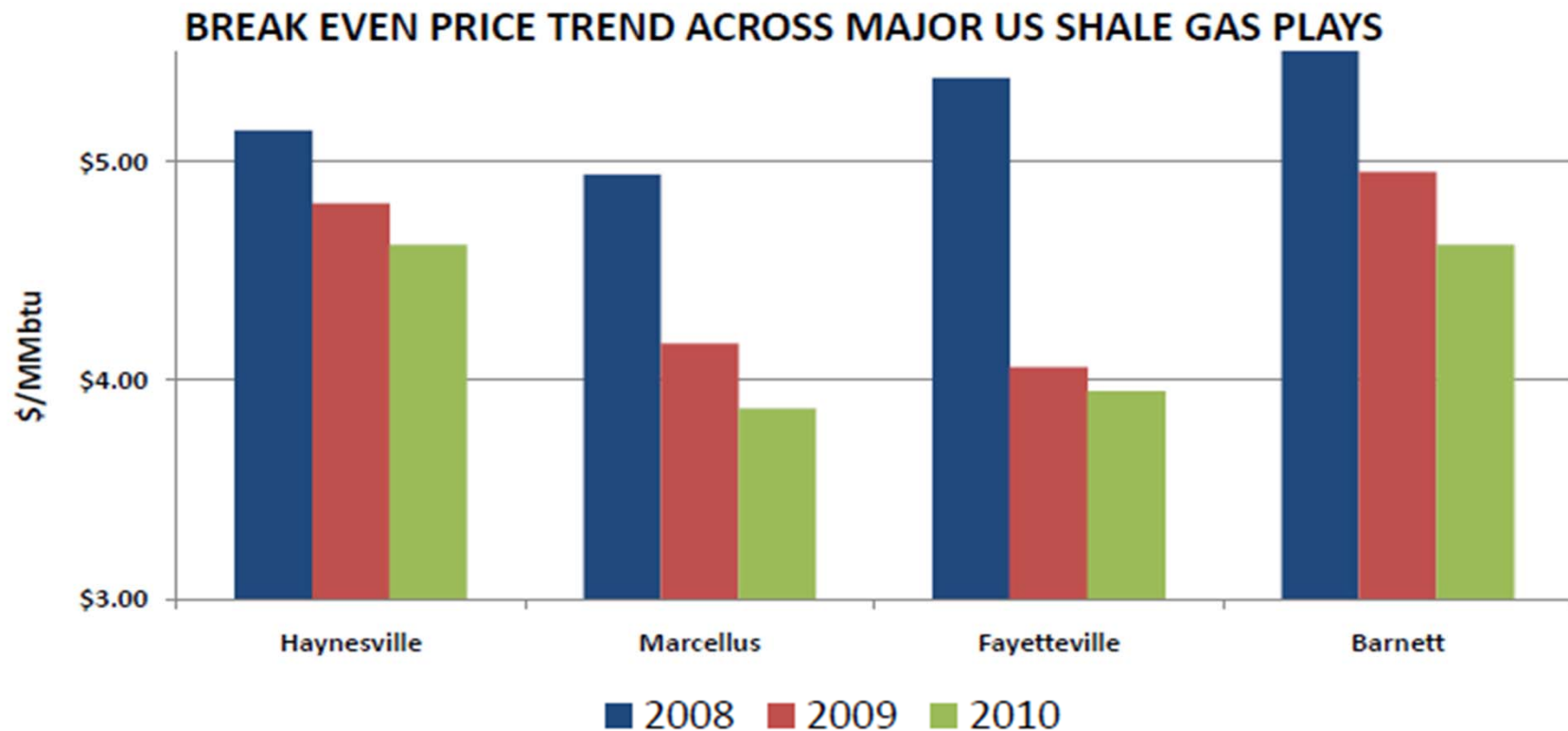
Required Prices for a 20 Pct IRR, by



Provided by Jeffries & Company

Technology Has Enabled Reduction In Breakeven Prices

- CAPITAL INFLUX IS A RESPONSE TO IMPROVING ASSET ECONOMICS IN MAJOR PLAYS



- TECHNOLOGY MADE SHALE GAS COMMERCIAL, NOW ENABLING REDUCTIONS FOR SURVIVAL

Source: Schlumberger Business Consulting Analysis

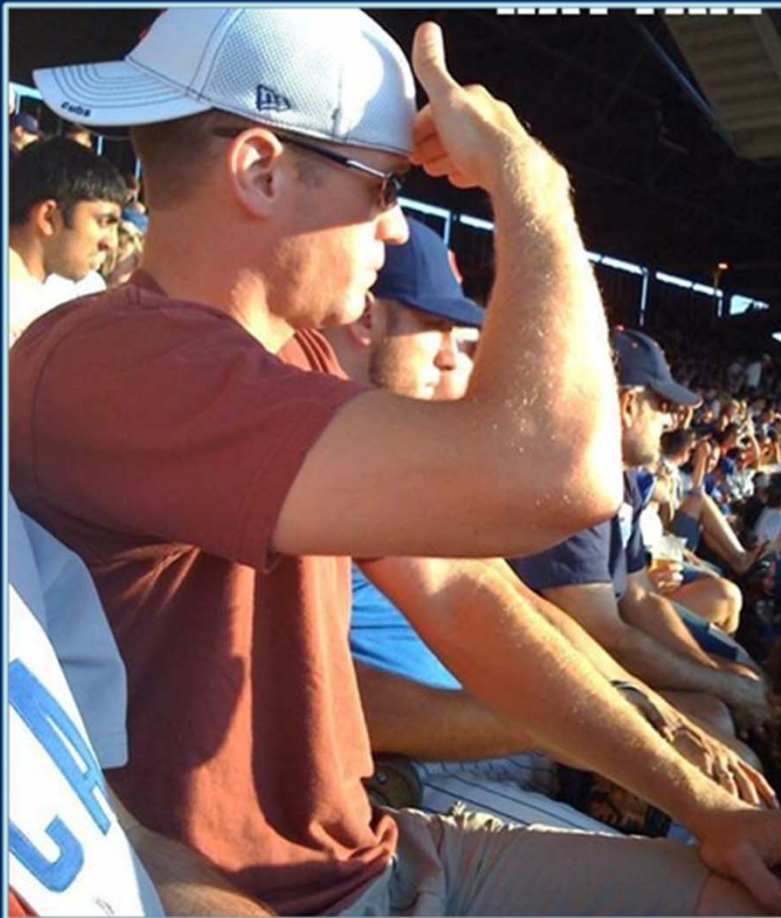


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Schlumberger

Not the Result of Big Tech Breakthroughs—Just Getting Very Good at Using the Existing Tools

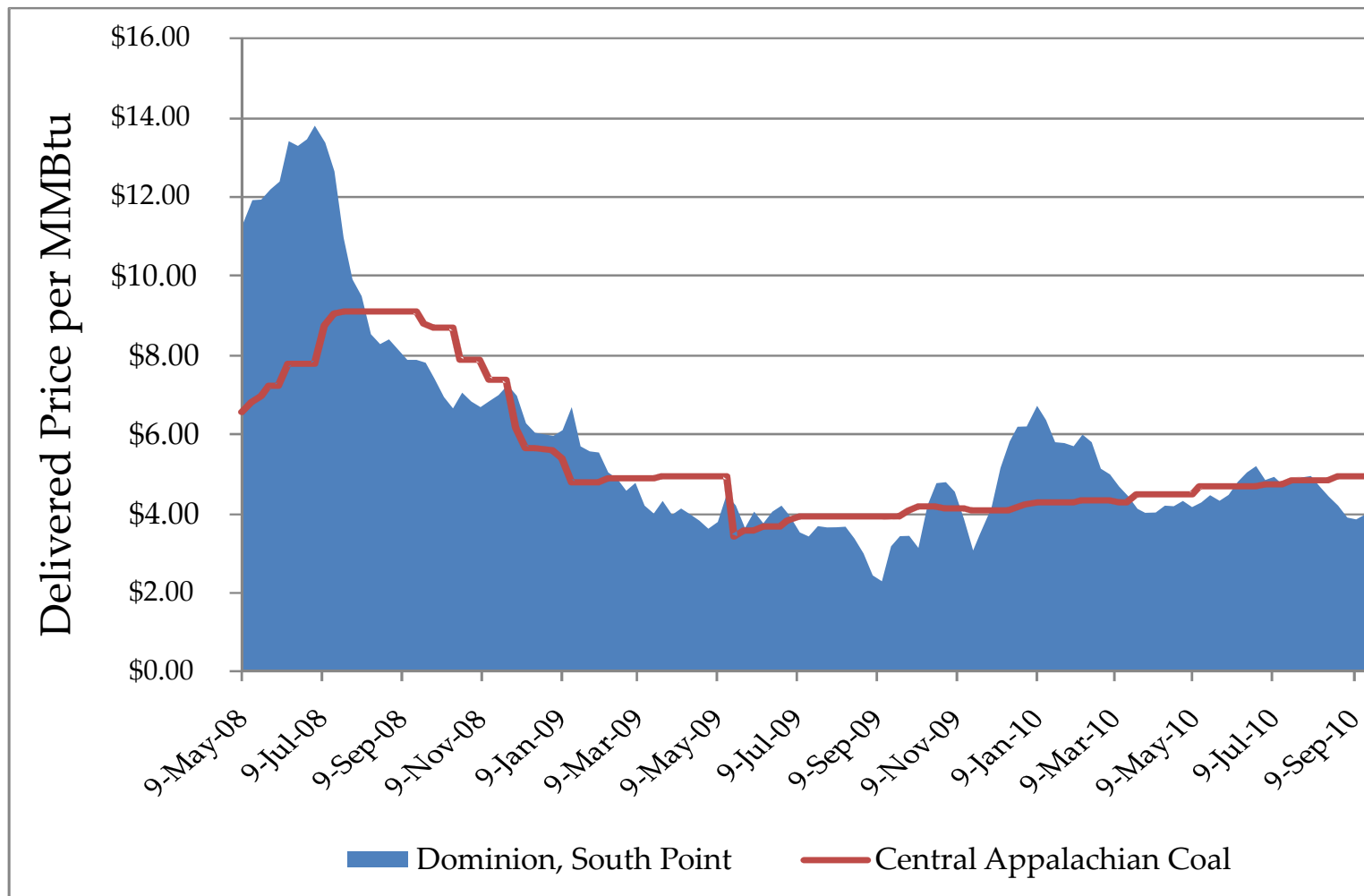
Use the tools you already have



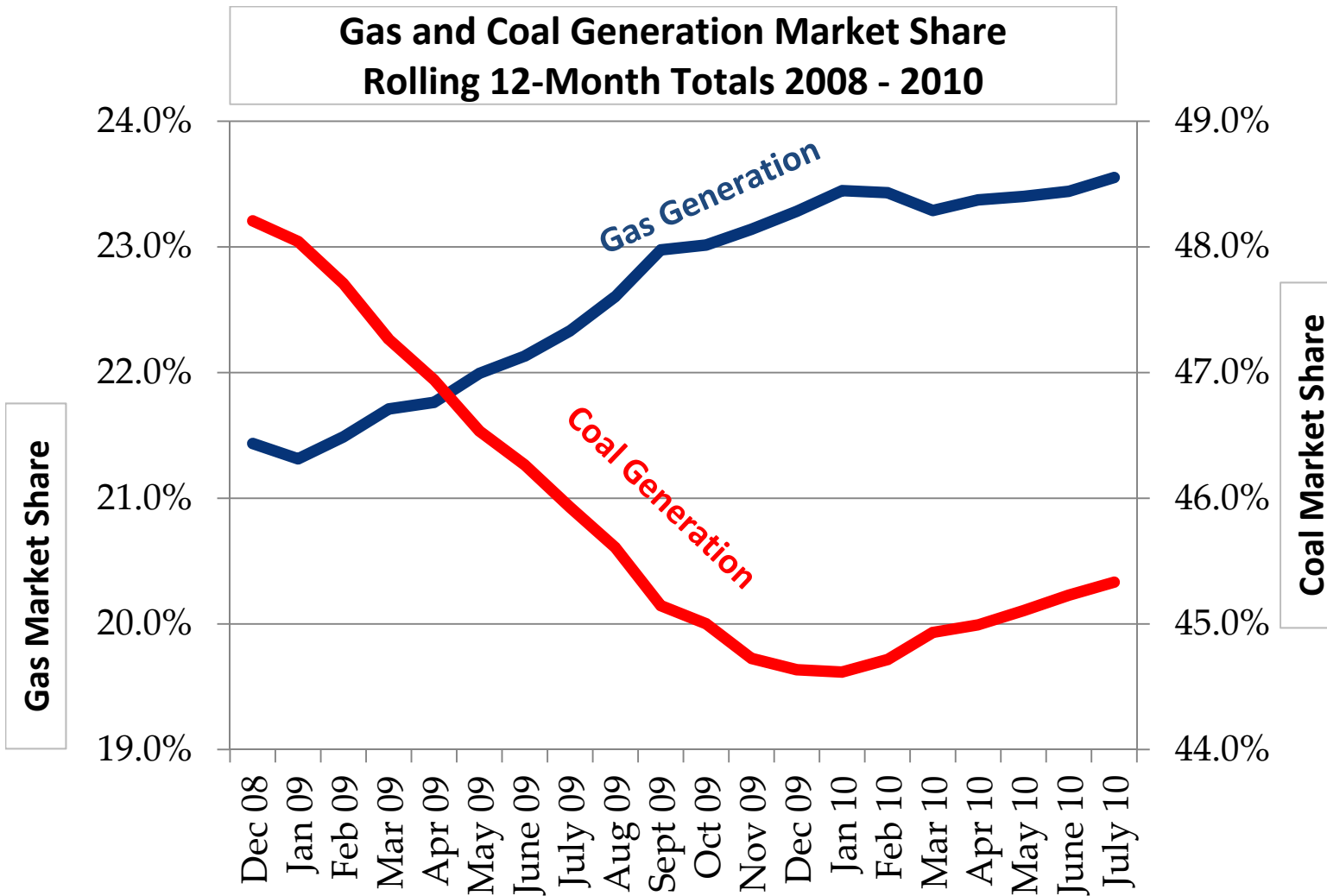
If only someone would invent something to keep the sun out of our eyes...

What Has All this Meant for the Competitive Position of Gas?

Delivered Eastern Coal vs. Appalachian Gas



Gas Has Gained Market Share vs. Coal, A Little Over 2 Percent



Challenges Faced in the United States

Market and Development Impact

- The Market is oversupplied—So prices have been in the \$3 to \$4 range, when most think it takes \$6 for full development—We need more demand.
 - Until now, lease retention, NGL production, and being in the “Sweet Spots” has kept development going at a high pace.
 - But without a stronger market, the industry will redirect toward oil, slowing the pace of development .
- The added supply, on top of EIA’s highest estimates, is enough to replace half of all coal use by 2020! This is a huge opportunity, but it is also a huge amount of supply to find a home for.
- Meanwhile, land impact, water questions around hydraulic fracturing, and road impacts are causing opposition to development.
- Of all those issues, hydraulic fracturing has been the most controversial—water supply and produced-water handling are the biggest environmental issues faced by the industry.

Key CONTACTS



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