

U.S. Natural Gas Outlook

**The 3rd London Gas & LNG Forum
September 26 and 27, 2016
The Rag Army & Navy Club
London**

***Lucian Pugliaresi
Energy Policy Research Foundation, Inc.
Washington, DC***

About EPRINC

- Founded 1944
- Not-for-profit organization
- Studies intersection of petroleum economics and public policy
- Provides independent and technical analyses for distribution to the public
- Funded largely by the private sector, foundations and U.S. government
- Supports USG projects, e.g. Quadrennial Energy Review, DoD strategic outlook
- www.eprinc.org



**ENERGY POLICY RESEARCH
FOUNDATION, INC.**

*Unique Insight into the World of
Petroleum Economics and Public
Policy since 1944*



EPRINC Embassy Series

- Engagement with Washington's energy policy community
- Collaboration among diplomatic community provides interesting venue and constructive policy discussion
- Series offers opportunity to gain greater understanding of U.S. energy policy in an era of expanding U.S. supplies of oil and gas



Main Themes

- *A Quick Comment on the Law of Diminishing Returns*
- *We Have Lots of Gas and its Very Inexpensive*
- *Implications of New Environmental Regulations on Exploration & Development, i.e. what are the regulatory threats to supply*
- ***Most important: What things cost is critical!!
(actually a repeat of point one)***

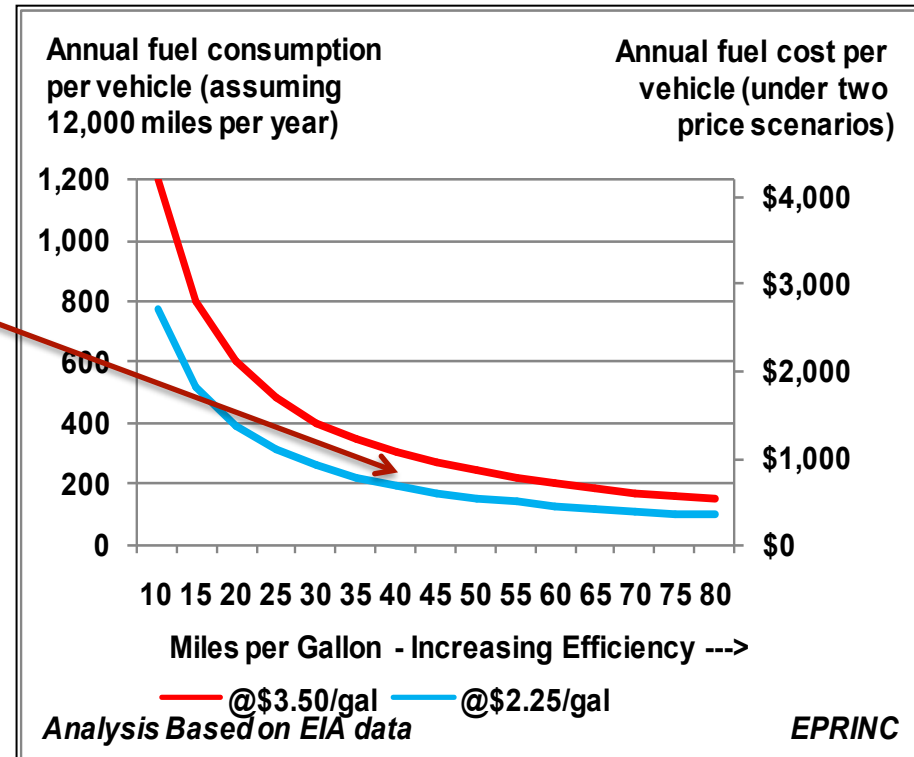
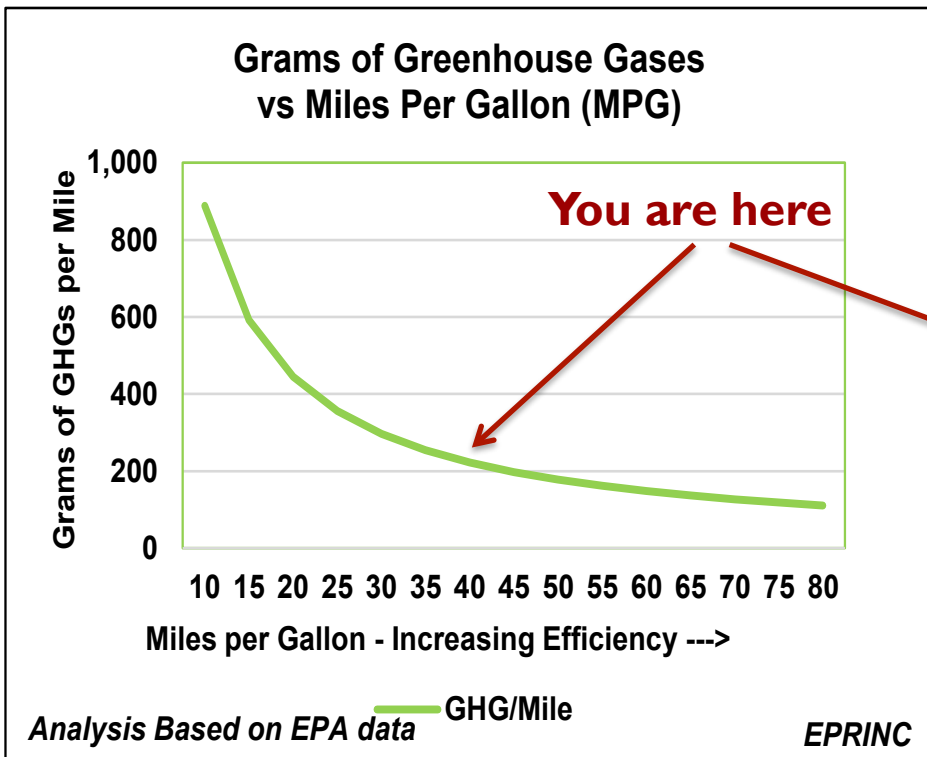
First, a few words about ...

THE LAW OF DIMINISHING RETURNS

emitte lucem et veritatem

A Comment on Environmental Regulation

How Much Should We Pay for the Last 10 Yards?



Source: Pugliaresi, L. and Max Pyziur, *CAFE, Gasoline Prices and the Law of Diminishing Returns*, March 2016, EPRINC

This is not a Defense of VW's Clean Diesel violation, but...

- Fuel economy is better than advertised for 2.0-liter diesel, averaging 45 miles per gallon on highway and 30 in city
- Output of GHG emissions, averaged at 50 percent or more below federal standards, but VW violated the NOx standard, at a level of at least **15 times the standard**
- But the average gasoline-powered pickup truck puts more NOx pollution than the typical Volkswagen diesel—and there are more than 10 million such trucks on the road
- Security delays on vehicles waiting to enter San Diego from Mexico produce 157 tons of extra NOx pollution—**VW's entire violation (for California) is approximately 90 tons of Nox**
- Next year, the average new car will have cut pollution by **99.4 percent** compared to 1963 models

The Resilience of the U.S. Natural Gas Resource

emitte lucem et veritatem

Understanding American Political Comments vs. Reality

“So by the time we get through all of my conditions, I do not think there will be many places in America where fracking will continue to take place.”

— Hillary Clinton, March 6, 2016

“The Marcellus Shale, the nation's largest play, will yield in March 2016 nearly 2 bcf/d more than EIA forecast just 30 days ago. New production from Pennsylvania caused the change from improvements in productivity and pipeline capacity.”

—Josef Lieskovsky (EIA), March 9, 2016

WESTERN INTERIOR SEAWAY

Stanley, Steven M. (1999). *Earth System History*. New York:W.H. Freeman and Company.

Shale Gas Play Map

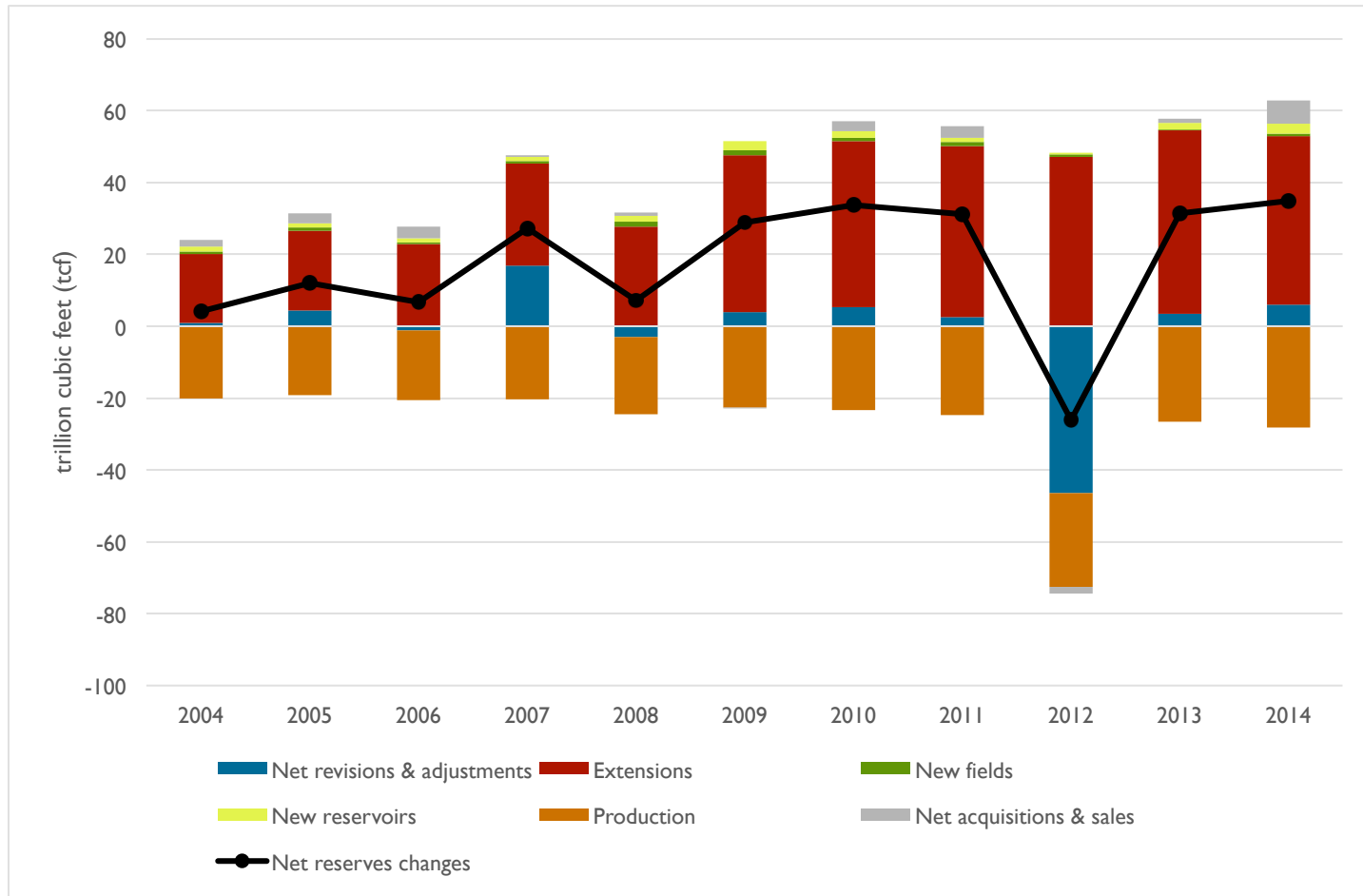
Shale plays in the Lower 48 states



Source: EIA

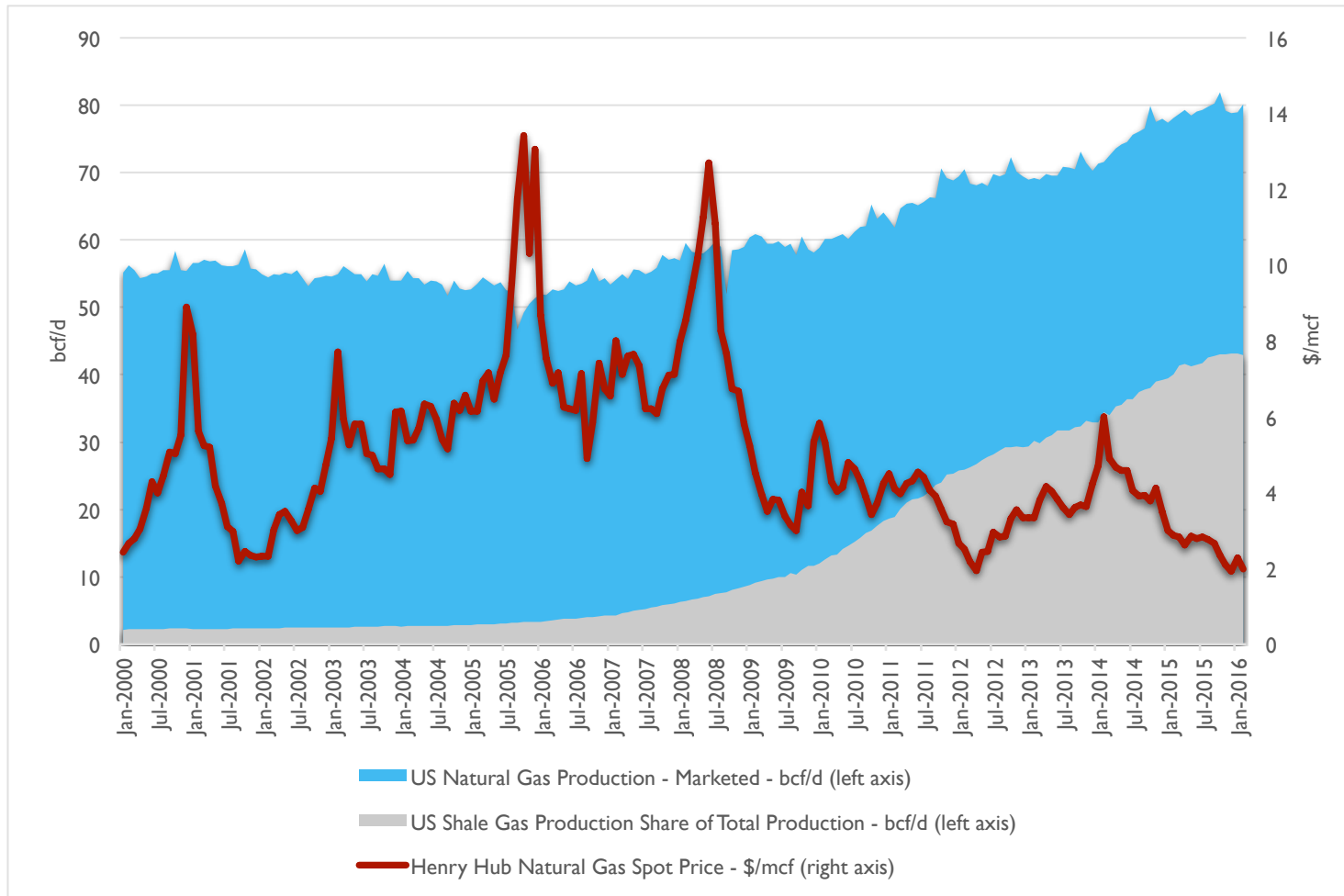
emite lucem et veritatem

Changes in Proved Reserves of the United States, 2004-2014 (trillions of cubic feet of natural gas)



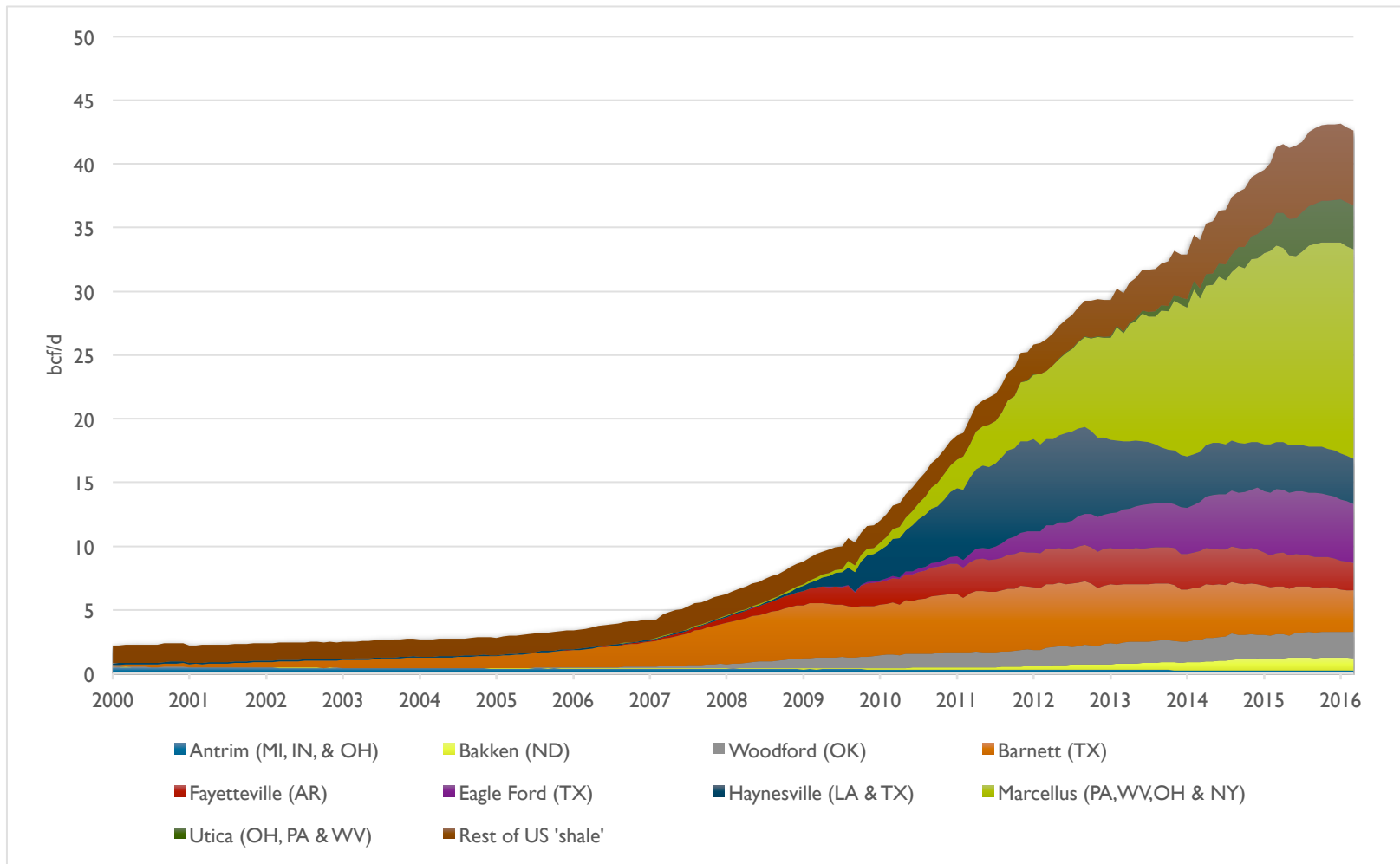
Source: EIA Data

U.S. Natural Gas and Shale Gas Production with Henry Hub Prices



Source: EIA Data, EPRINC/PetroNerds Calculations

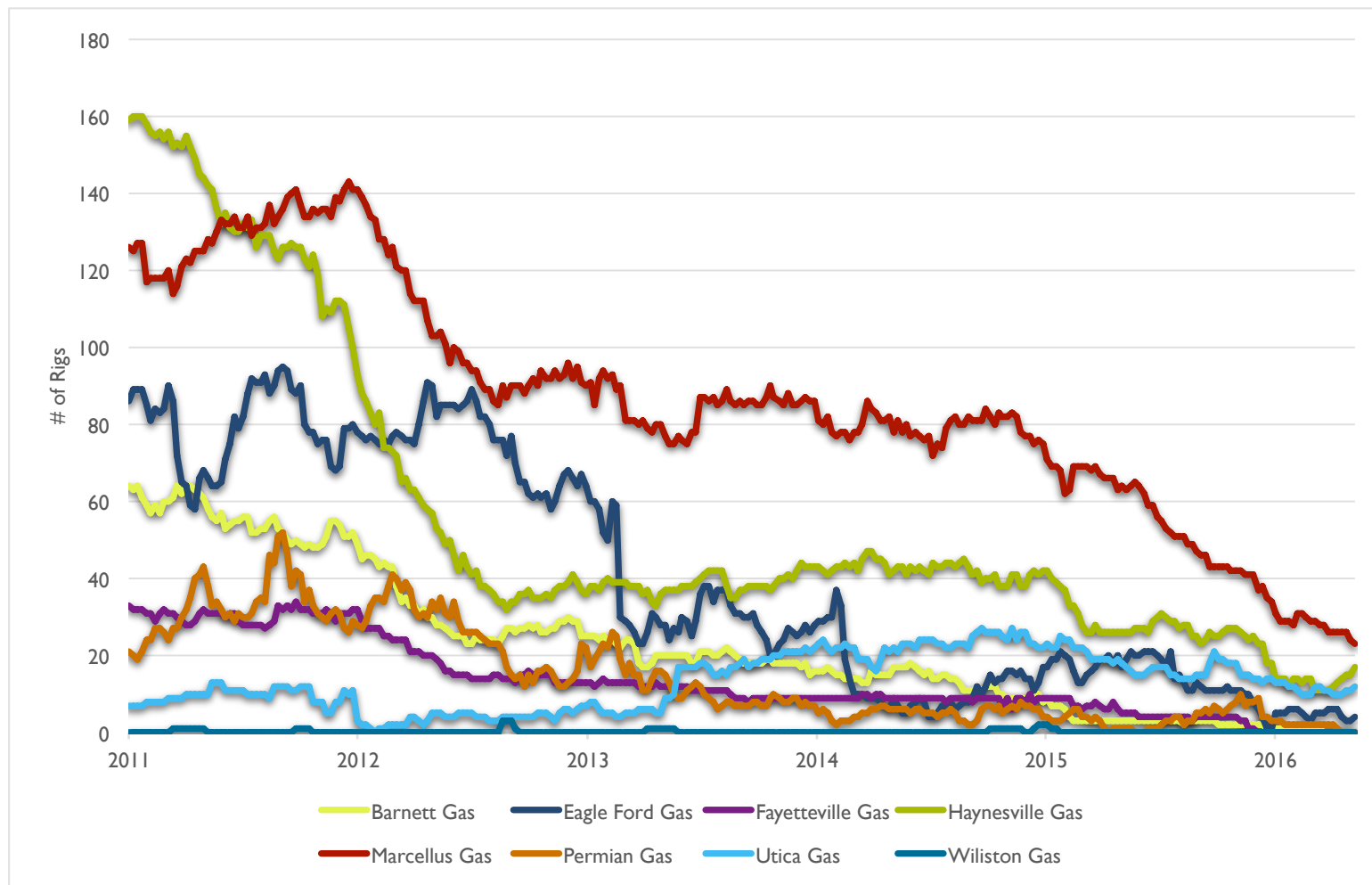
Gas Production by Major Shale Play



Source: EIA data, PetroNerds calculations

emitte lucem et veritatem

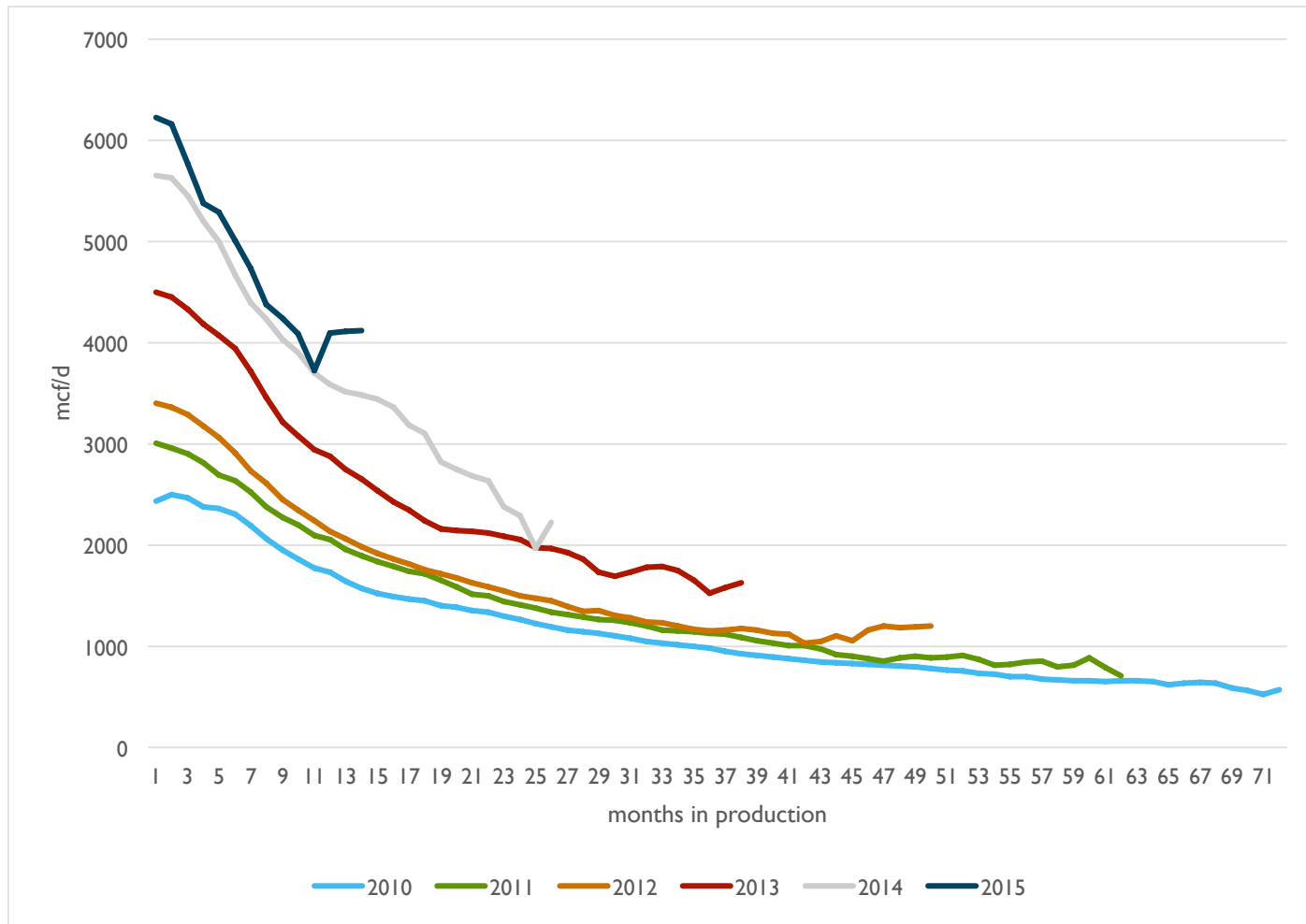
U.S. Gas Rig Count by Basin



Source: EPRINC Report Shale Gas; The Road Ahead (August 2016)

emite lucem et veritatem

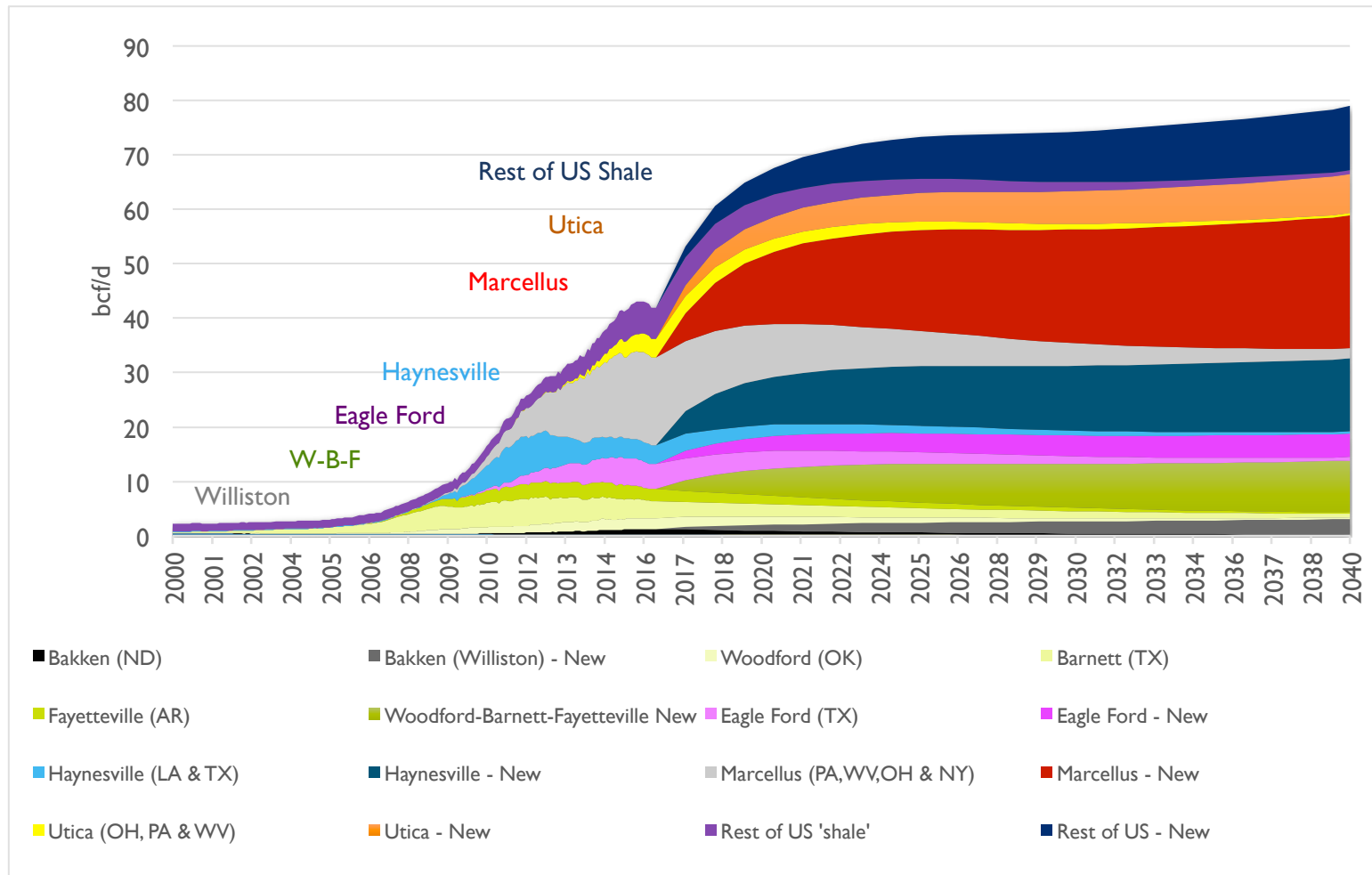
Marcellus Gas Type Curves 2010-2015



Source: EPRINC REPORT, *Shale Gas: The Road Ahead* (August 2016)

emitte lucem et veritatem

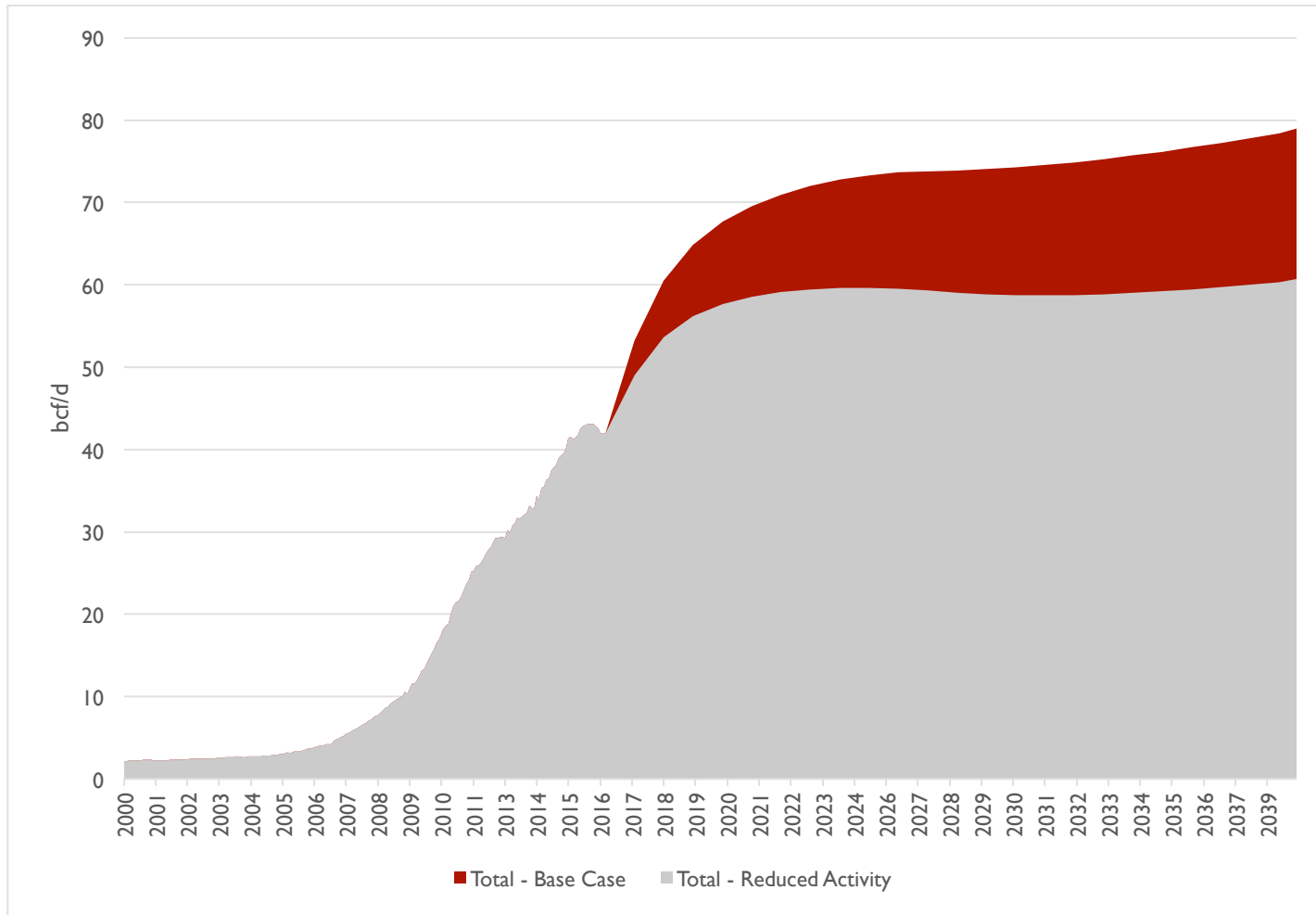
Base Case Shale Gas Forecast by Play



Source: EPRINC Report *Shale Gas: The Road Ahead* (August 2016)

emite lucem et veritatem

Shale Gas Production Under Two Scenarios



Source: EPRINC REPORT, *Shale Gas: The Road Ahead* (August 2016)

emitte lucem et veritatem

CAN US LNG EXPORTS REMAIN COMPETITIVE IN LOW PRICE ENVIRONMENT?

- Substantial number of facilities with relatively low development costs still exist (i.e., capital investments were made at sites for LNG import terminals)
- Most projects in planning are large train (5 million metric tons/yr), but have capability for cost-effective downsizing.
- In general, US has low inflation and low currency volatility risks
- Pending methane regulations could reduce supply and leave it in the ground movement also poses risks (Keystone Pipeline & Dakota Access Pipeline Syndromes)