

North American Natural Gas Supply Assessment Executive Summary and Update

Prepared for:
The American Clean Skies Foundation
July 2008
Updated to Address
**The Energy Information Administration's
2009 Annual Energy Outlook**



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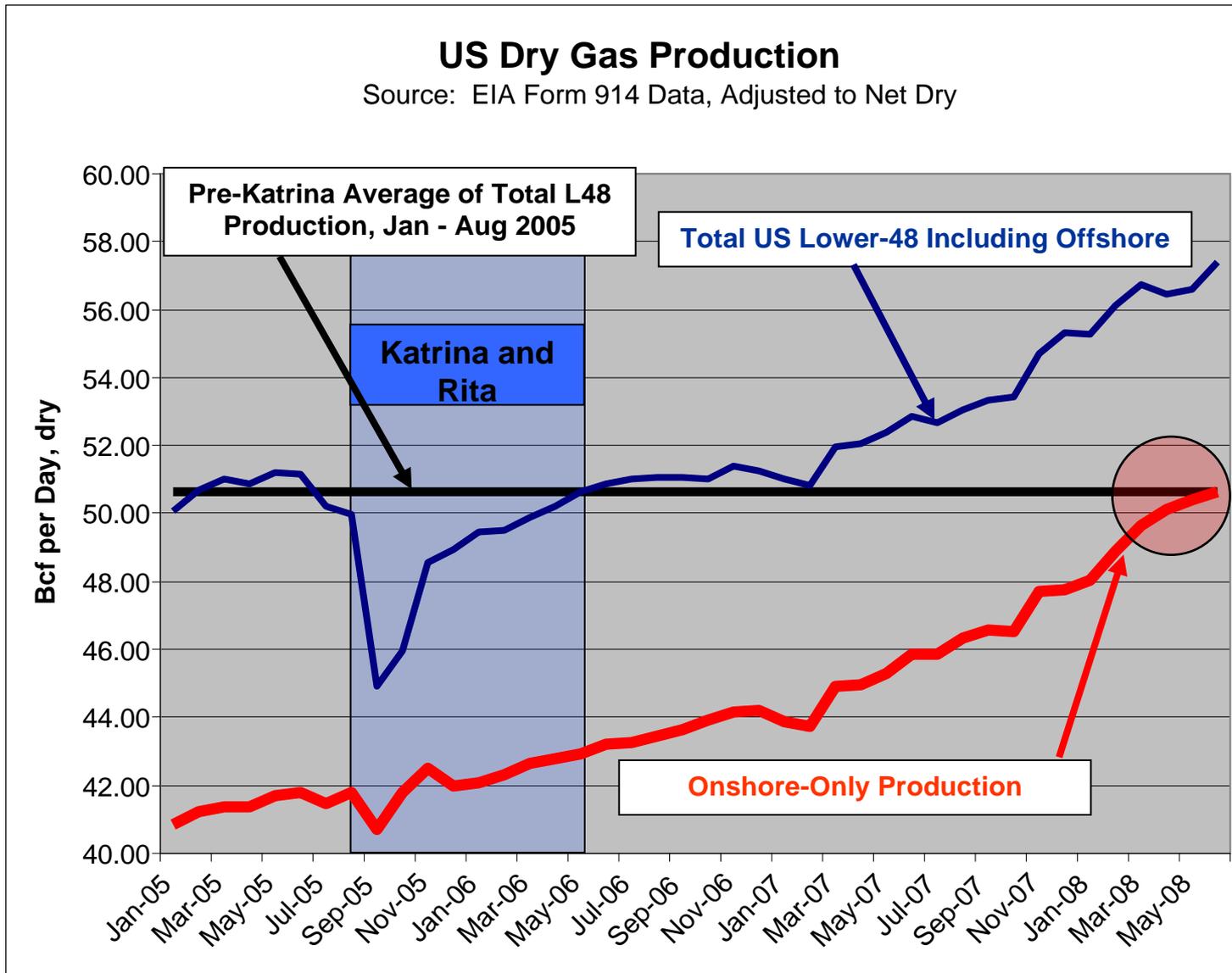
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Introduction » Assignment and Findings

Updating the State of North American Natural Gas Supply

- **Assignment:** Update the state of North American gas supply and potential, especially U.S. unconventional gas.
 - Emphasize shale gas, since it is growing the fastest
 - Evaluate both production growth and resource potential
- **Process:** Combination of public sources and direct outreach to producers and state agencies, plus extensive data from Lippman Consulting Inc.
 - 114 producers covering 90 percent of North American production—60 percent response rate
 - Production officials in all major shale-producing states
- **Findings:**
 - Production has increased rapidly from all onshore sources, to the point that U.S. onshore-only is equal to the pre-Katrina total for all U.S. sources.
 - The recoverable resource is not constrained, constituting something between 1,680 and 2,247 Tcf, or 88 to 118 years at 2007 rates of production.
 - Production growth in shale has been exponential, and even with slowdowns caused by current market and financial turmoil, can increase available U.S. supply by over 30 percent by the mid-2020s.

As of June 2008, Onshore Production by itself Reached the Pre-Katrina Value for Total Lower 48 Production

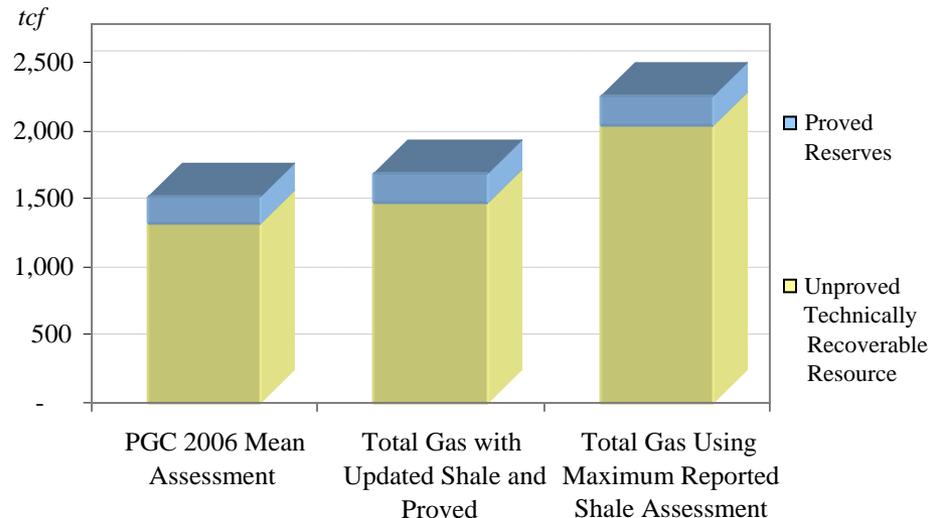


NCI Conclusions » Total Gas Supply

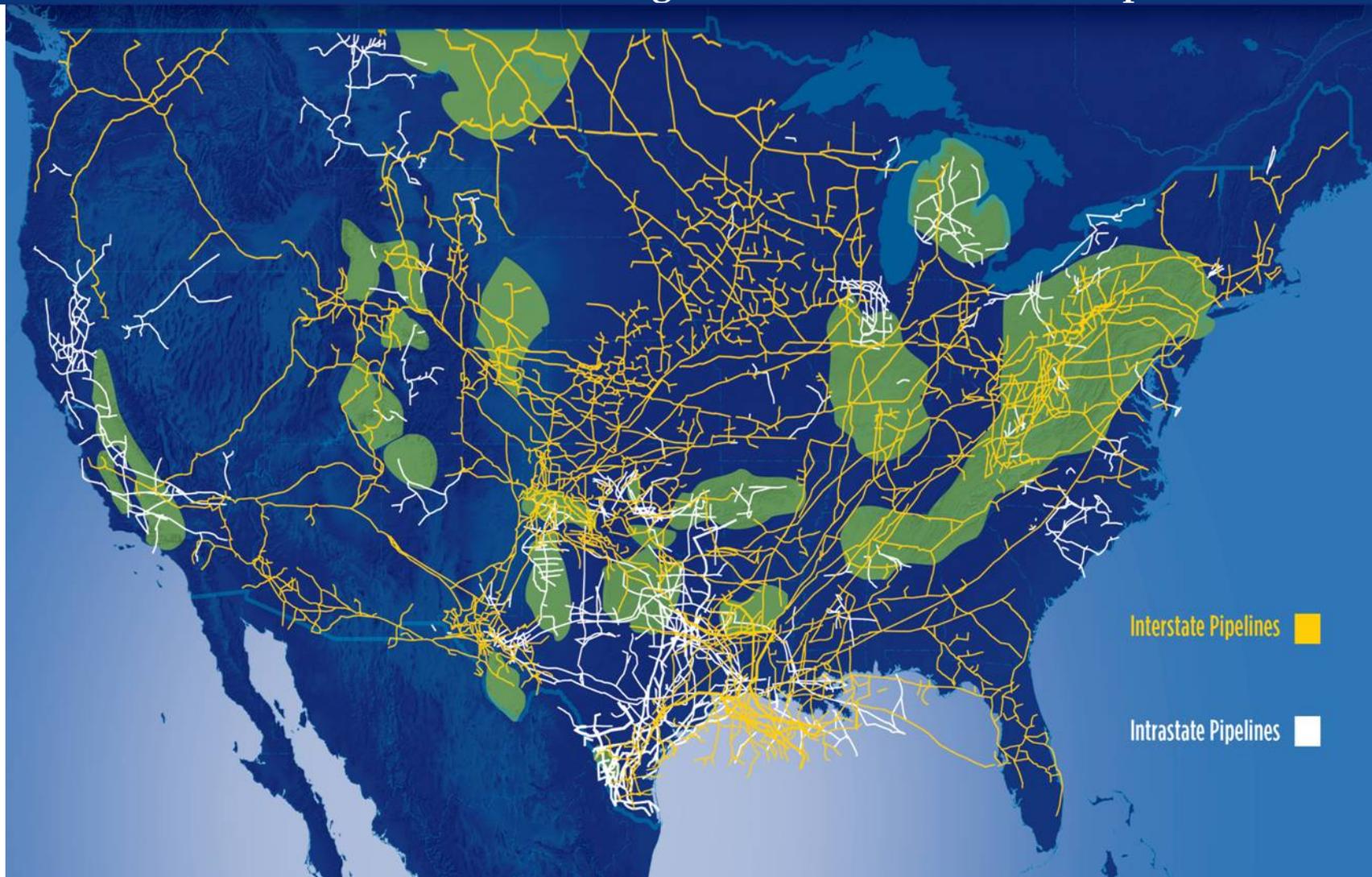
Proved Reserves Plus Assessed Resources—Life of the Gas Resource

- The 2006 PGC Report's total P3 Resource estimate was reported at 1,530 Tcf, inclusive of 204 Tcf of Proved Reserves. At that year's U.S. Production Rate, this is 82 years' worth of gas supply.
- The mean NCI estimate for Shale Gas is 274 Tcf, approximately 143 Tcf higher than the Shale Gas reserves estimated to be included in the PGC estimate. Adjusting for this difference, and for higher proved reserves (211 Tcf) as of year-end 2007, the total resource becomes 1,680 Tcf, 88 years' worth of supply at 2007 production levels.
- The maximum reported assessment for shale, according to producer reports collected by NCI, is 842 Tcf. Using this estimate, the total would increase to 2,247 Tcf, 118 years of production at 2007 levels.

U.S. Total Gas Supply (Tcf)



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



Sources: EIA, US Natural Gas Pipeline Network

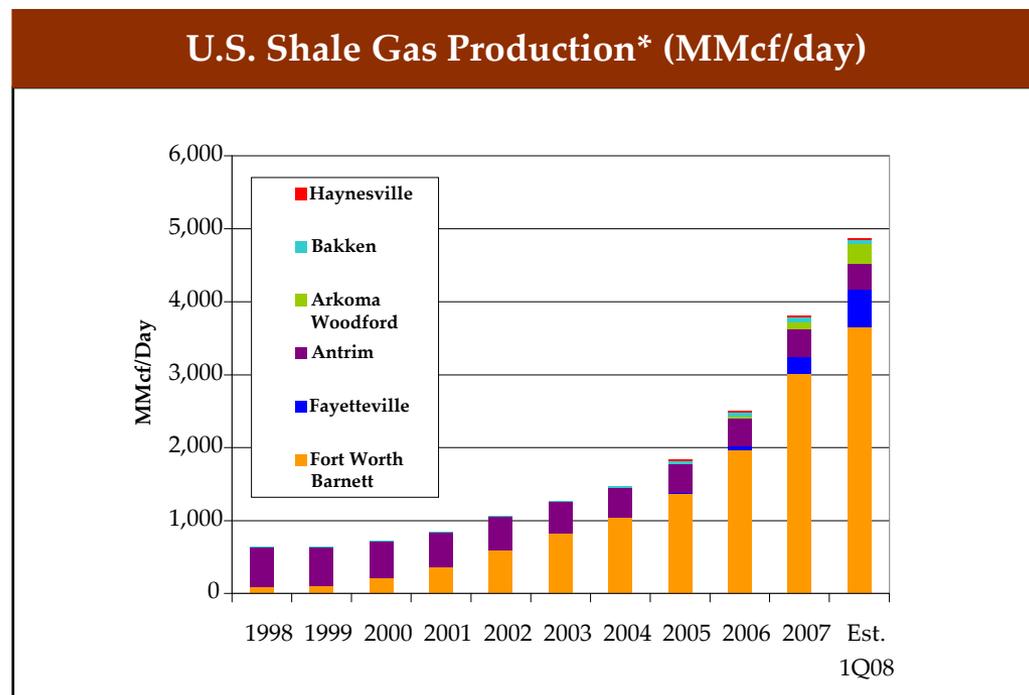
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U.S. Gas Shales » Shale Production by Play

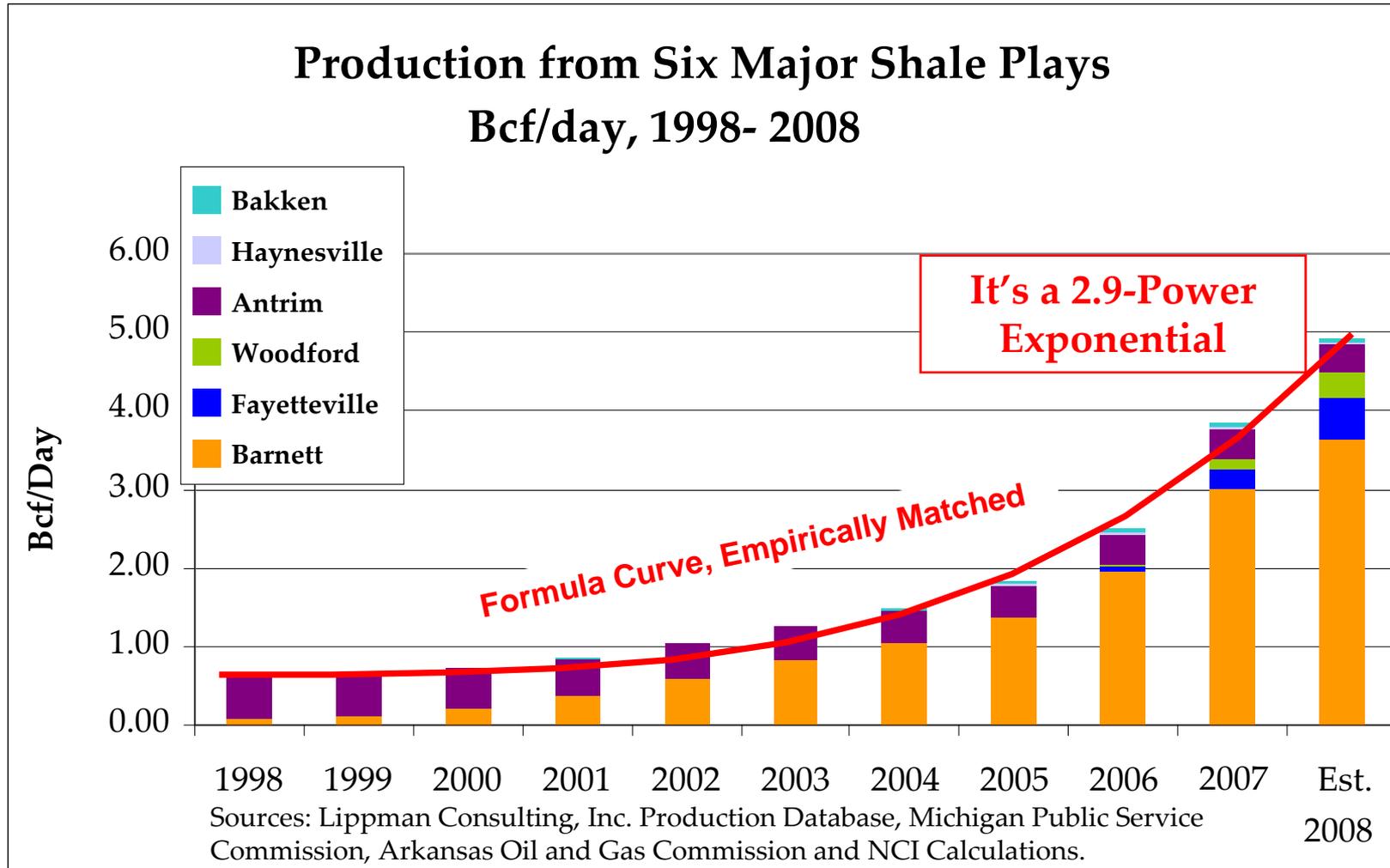
Gas Shale Production has Experienced Tremendous Growth in Recent Years with Barnett Leading the way and Signs of Early Followers

- Barnett has grown from 94 MMcf/day production levels in 1998 to 3,014 MMcf/day in 2007; an increase of more than 3000%.
- Fayetteville, Haynesville and Woodford are all showing similar signs of ramping production. Marcellus will be next.
- Technology has allowed access to and economic production of a vastly greater resource base. Specifically, improved hydraulic fracturing techniques and greatly improved horizontal drilling have allowed tight, geographically diffuse reserves to be developed in large volumes.
- Producer estimates placed the “Big 6” plus Marcellus at 27 to 39 Bcfd upon full development.



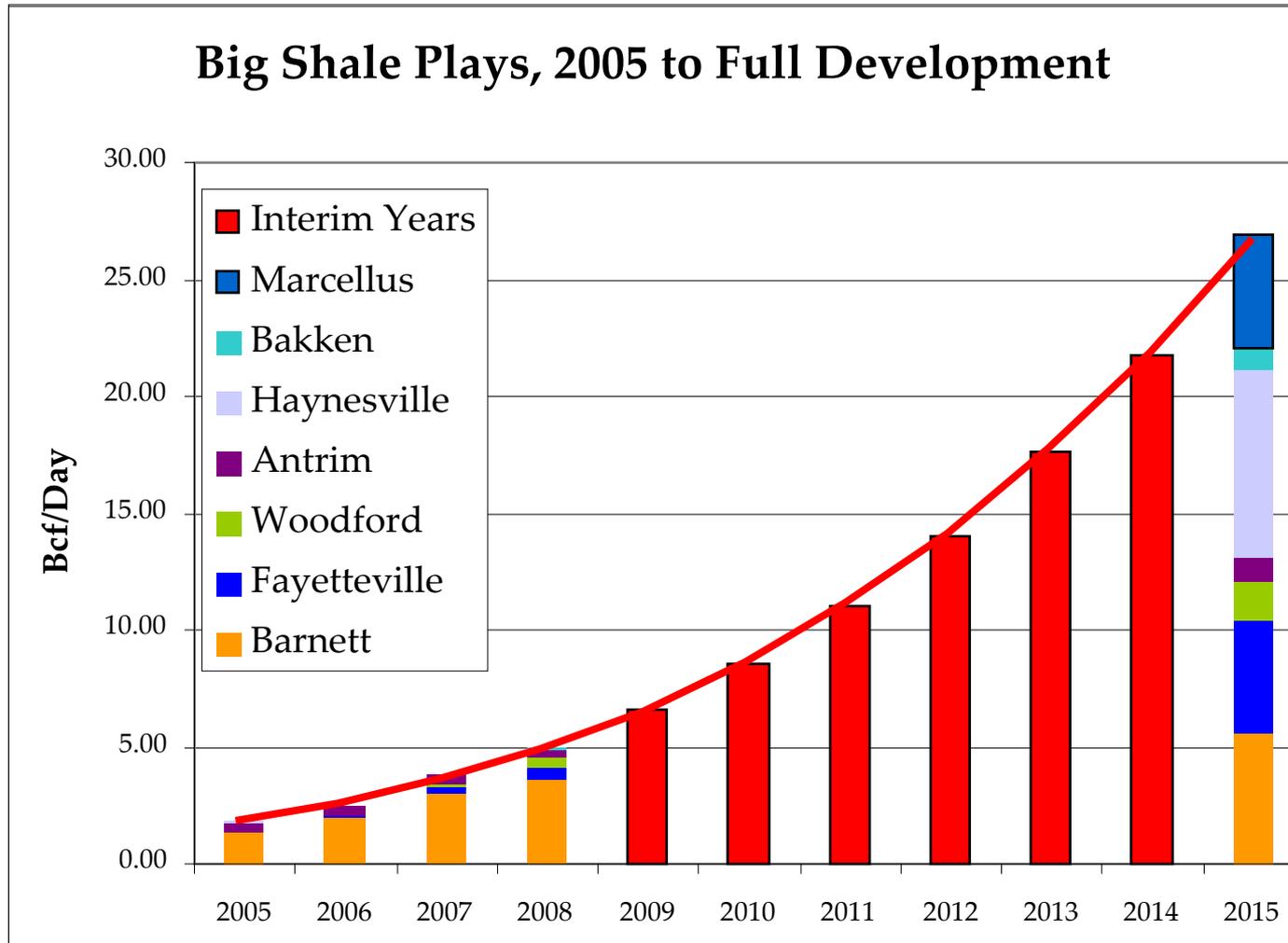
Sources: Lippman Consulting, Inc. Production Database, Michigan Public Service Commission, Arkansas Oil and Gas Commission and NCI Calculations.

The Accelerating Run-Up in Shale Production—An Exponential Curve



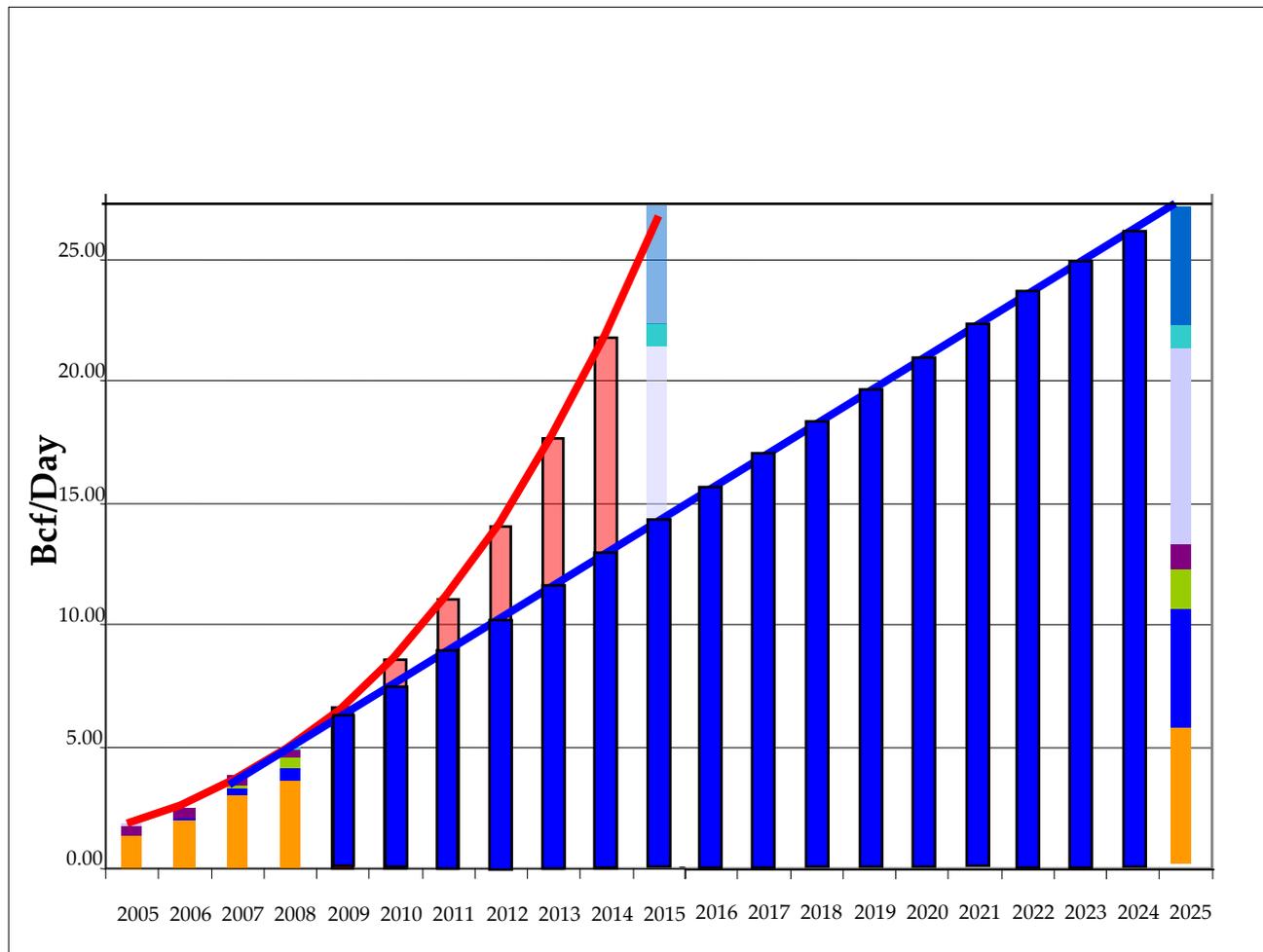
The Accelerating Run-Up in Shale Production—Extended to the Future

If the acceleration continued, 27 Bcf/Day by 2015—
Too Much for the Market



The Accelerating Run-Up in Shale Production—The More Likely Answer

Slow down a little to straight-line growth, to match the market. So even with recent slowdowns, shale gas is well-poised to add significant supply when it's needed.



How Much Can Shale Contribute to Fueling Vehicles?

- EIA 2009 Forecast of Total U.S. gas supply in 2025 ¹/₁: 23.61 QBtu (22.97 Tcf)
- Shale gas included in that estimate for 2025 ¹/₁: 4.93 QBtu (4.80 Tcf)
- Incremental Shale Gas Available at 27 Bcfd: 5.20 QBtu (5.06 Tcf)
- EIA 2009 Forecast of Total U.S. Liquid Vehicle Fuel in 2025 ¹/₁: 25.16 QBtu
- Percent that Could be Displaced by new Natural Gas Vehicles ²/₃/₁: 21 percent
- Equivalent Displacement of Imported Oil: 5.20 QBtu/year = 2.4 million Barrels/Day

¹/₁ Source of EIA numbers is the recently released 2009 Annual Energy Outlook of the U.S. Energy Information Administration—shale included in unconventional is estimated.

²/₃/₁ “Natural Gas Vehicles” refers both to Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG). It is important to distinguish this LNG application from the importation of gas in liquid form from other countries. For vehicles, liquefaction is just a way to facilitate storage of the gas in a tank, with the gas coming primarily from domestic sources.

³/₁ EIA does recognize some use for NGVs in 2025, at 0.08 QBtu. So this would represent a hundredfold increase in EIA’s forecast for NGV use.

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**The Full North American Natural Gas Supply Assessment
Is Available for Download at www.cleanskies.org**