

North American Natural Gas

## Production Outlook by Major Basin, and Facilities Options, Edward Kelly, IHS Inc.

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ihS.com

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# Contents

## OUTLINE

### THE RESOURCE BASE AND COST STRUCTURE

The Marcellus/Utica, and All Else

### A PLAY BY PLAY TOUR of GAS PRODUCTION POTENTIAL

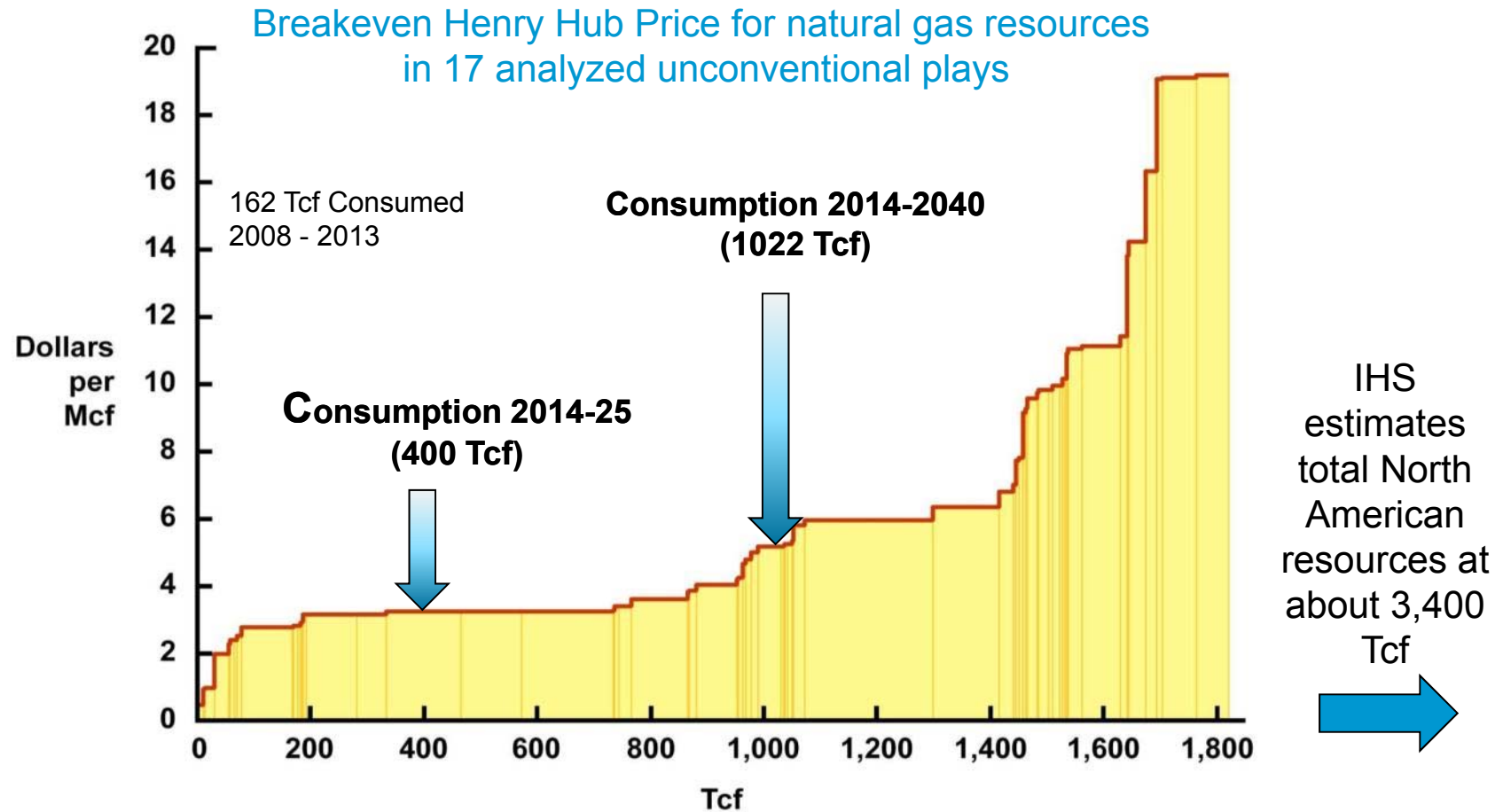
Marcellus

Utica

Haynesville

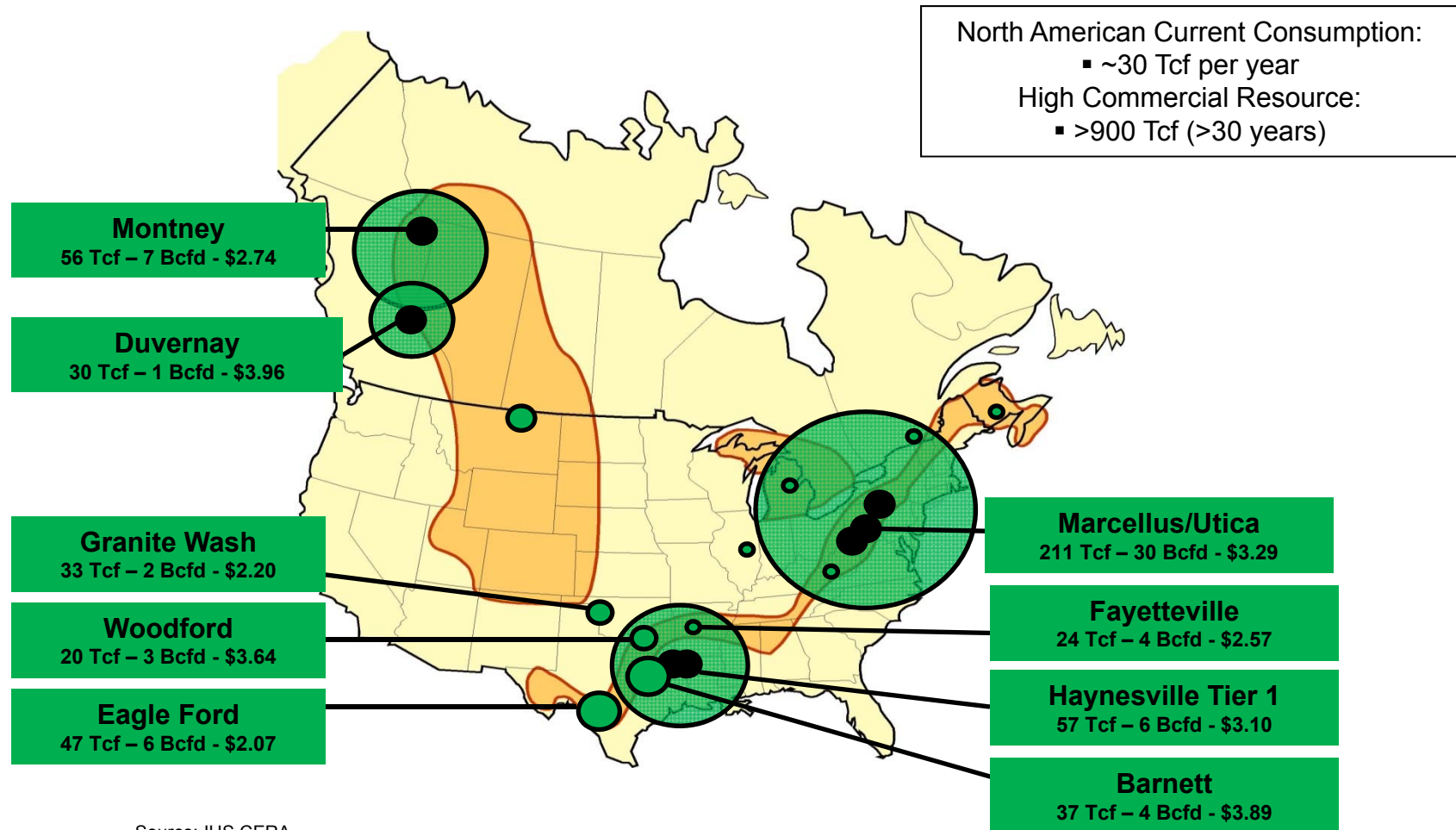
## COMMENTS

# A Larger perspective: North American gas supply is plentiful and low cost, and the resource base is not static



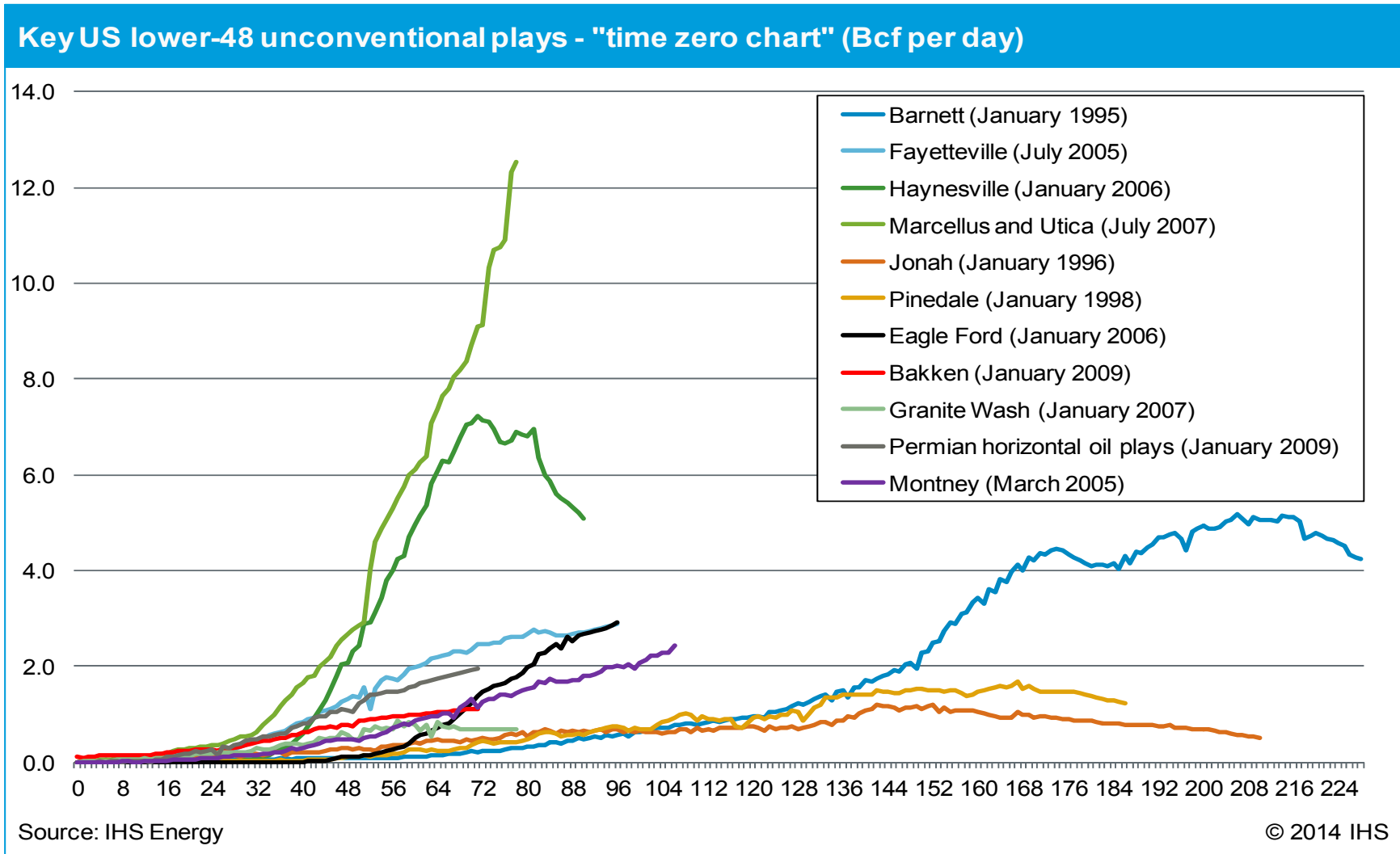
Source: IHS CERA, *Fueling North America's Energy Future*.  
 Note: Proved, possible, and potential resources.  
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# Updated Resource Estimates in Select Identified Plays; 515 Tcf at well below \$4.00

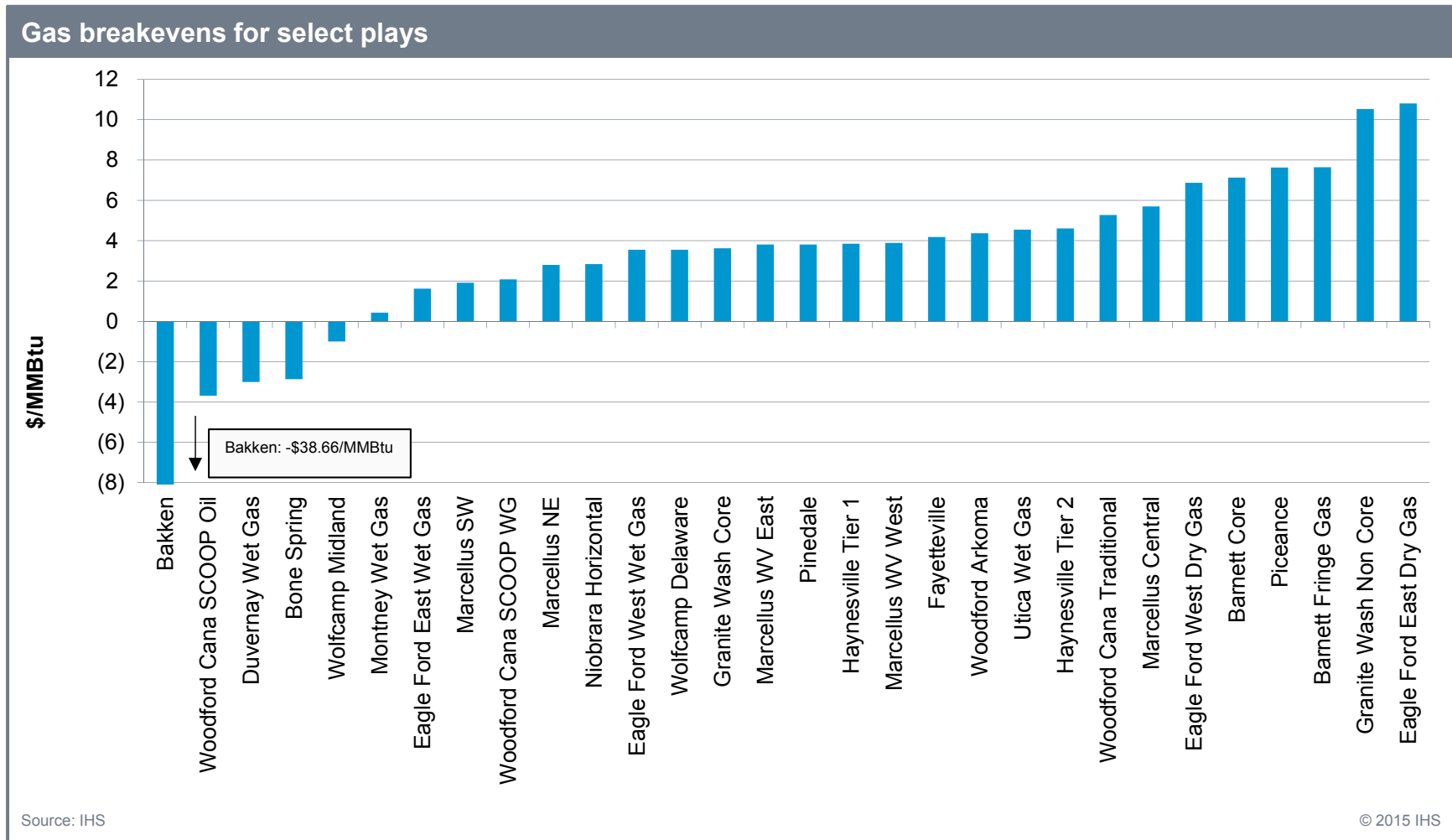


Source: IHS CERA.  
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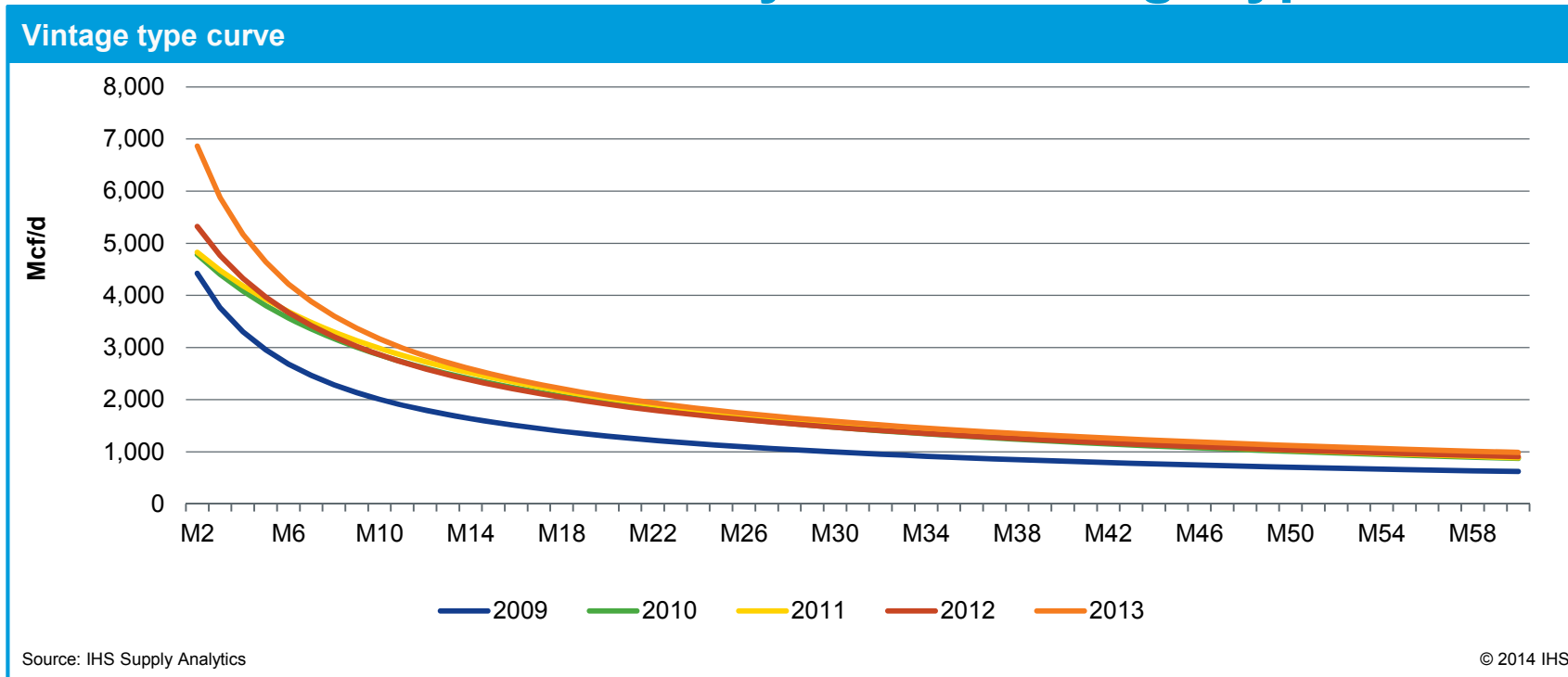
# Comparative Production Development Pace



# Gas breakeven prices



## Marcellus Northeast Pennsylvania: Vintage type curves

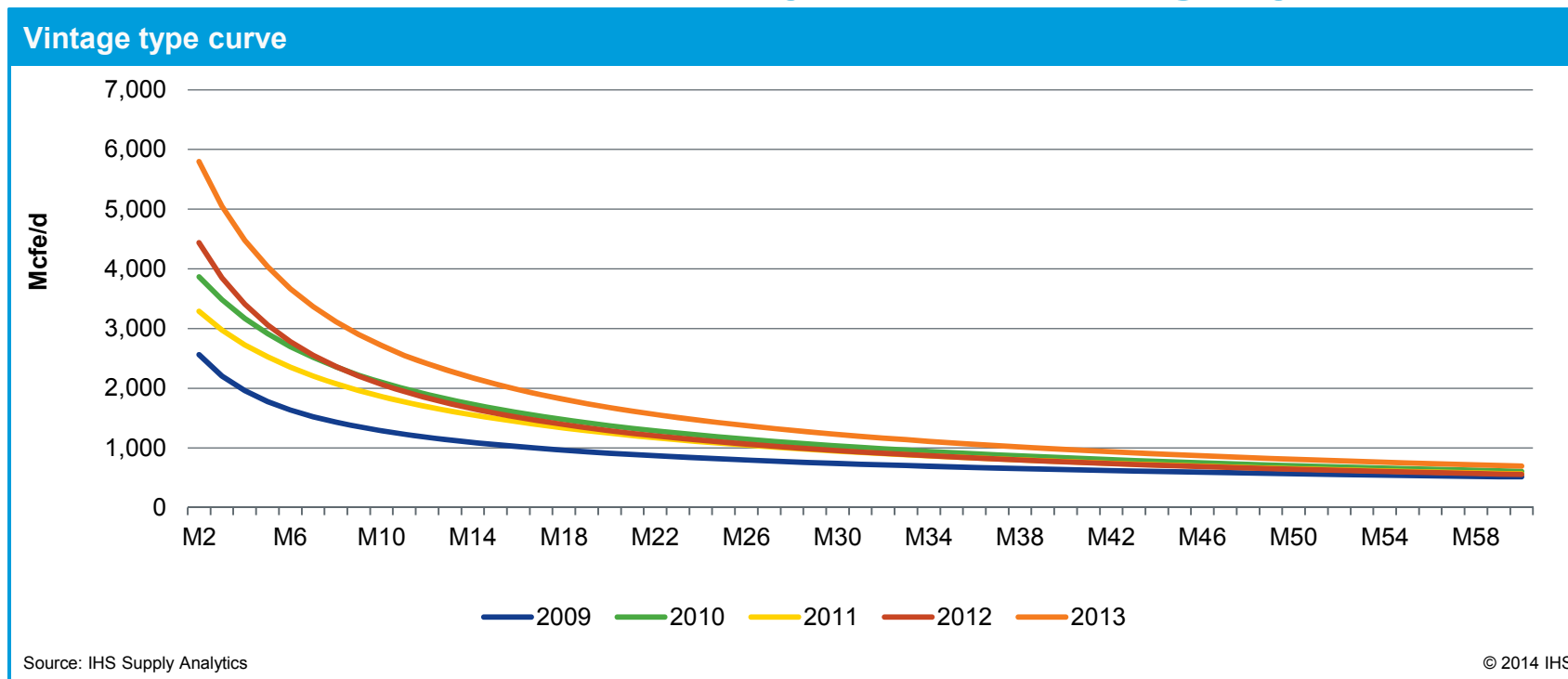


	2009	2010	2011	2012	2013
EUR oil (Mbbbl)	-	-	-	-	-
EUR gas (MMcf)	4,309	5,762	5,802	6,121	6,842

- Well productivity has improved over the years, especially those brought online in 2013. Peak rate increased by around 29% while EUR rose by 11% compared with 2012 wells.

Note: Mbbbl = million barrels.

# Marcellus Southwest Pennsylvania: Vintage type curves

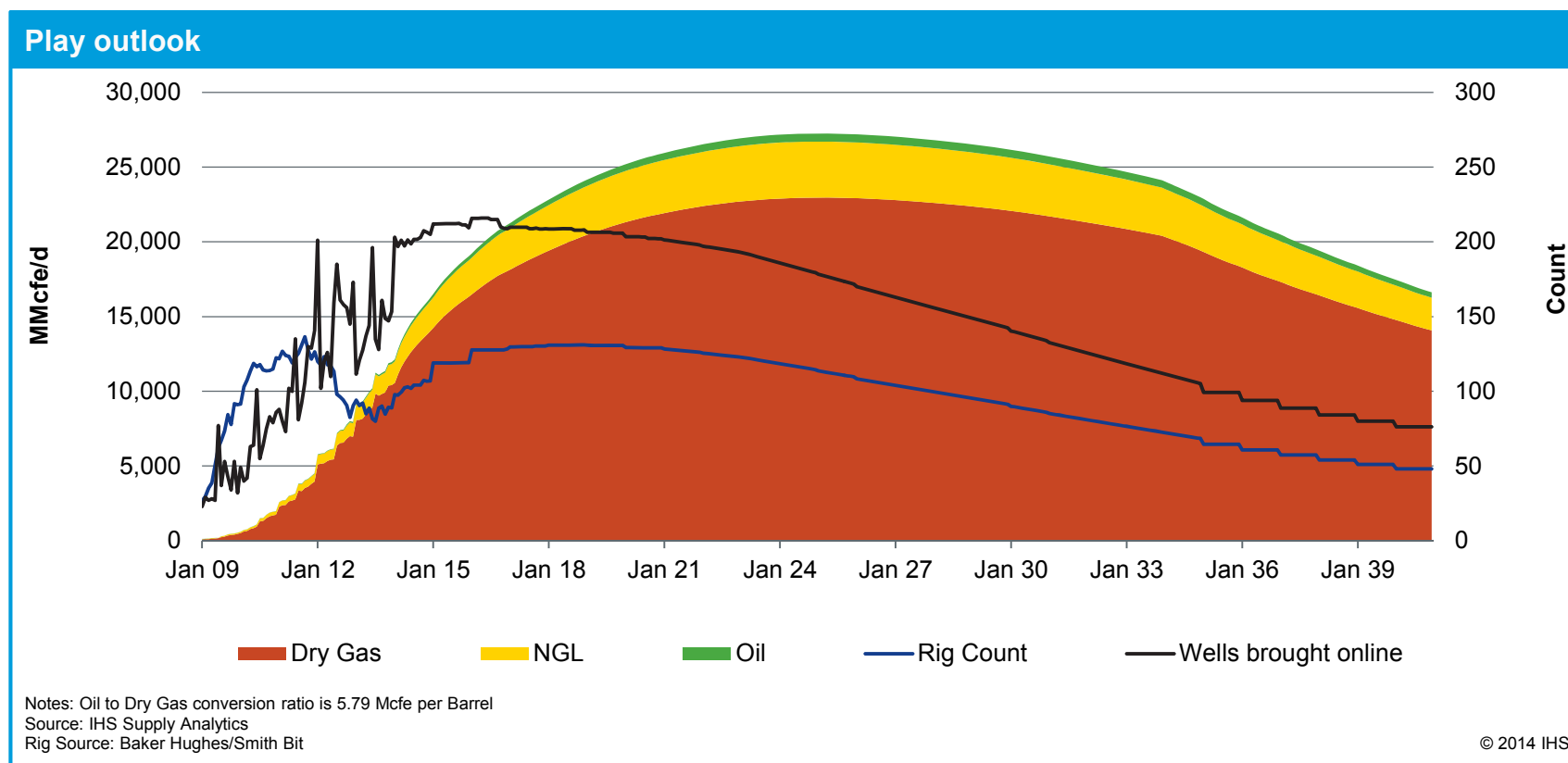


	2009	2010	2011	2012	2013
EUR oil (Mbbl)	67	53	53	78	93
EUR gas (MMcf)	3,062	3,815	3,463	3,476	4,406

- Wells in the Marcellus Southwest Pennsylvania have gotten stronger over time, especially those brought online in 2013, compared with 2012 wells. Both gas peak rate and EUR increased by 27%, while oil peak rate and EUR increased by 68% and 21%, respectively. The improvement is caused by rising lateral length, from 5,000 ft in 2012 to more than 6,000 ft in 2013. EQT Corporation (EQT) is the main driver of these recently high peak gas wells, while Range Resources Corporation (Range) drives up the average of liquids productivity.

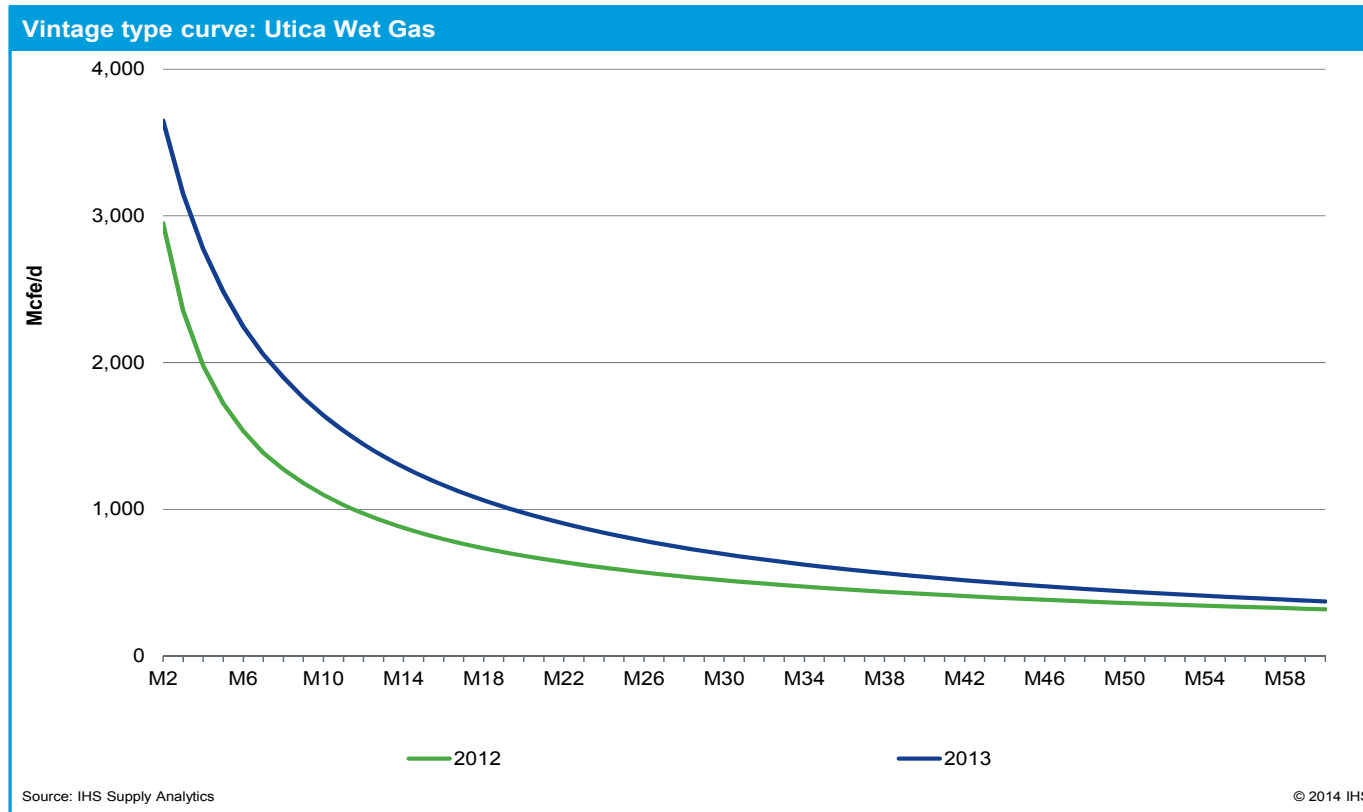


## Marcellus Total: Play outlook



- Gross production across Marcellus is expected to grow from 12 Bcfe/d in the end of 2013 to over 25 Bcfe/d by 2020.

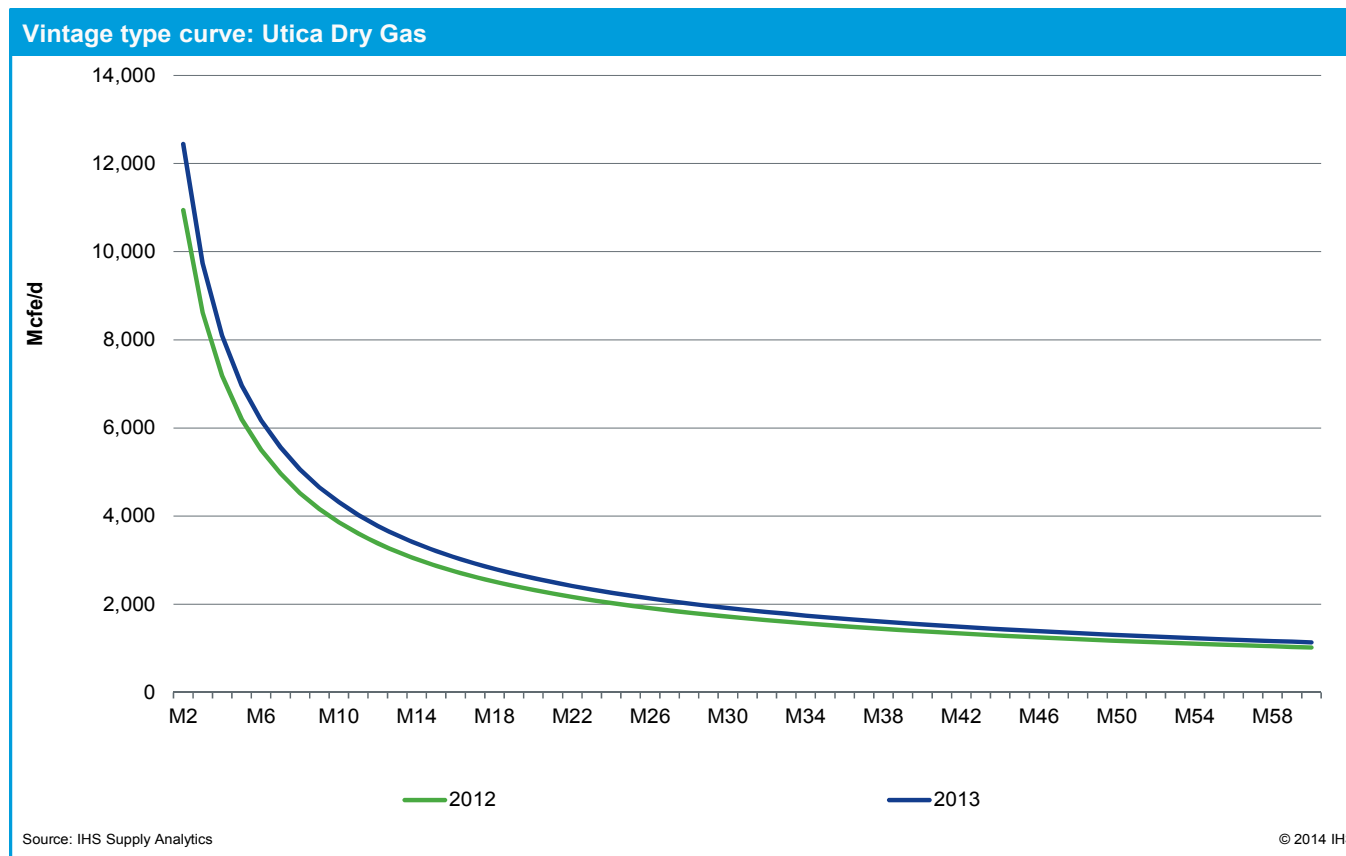
# Utica wet gas: Vintage type curves



	2012	2013
EUR oil (Thousand bbl)	54	74
EUR gas (MMcf)	1,998	2,274

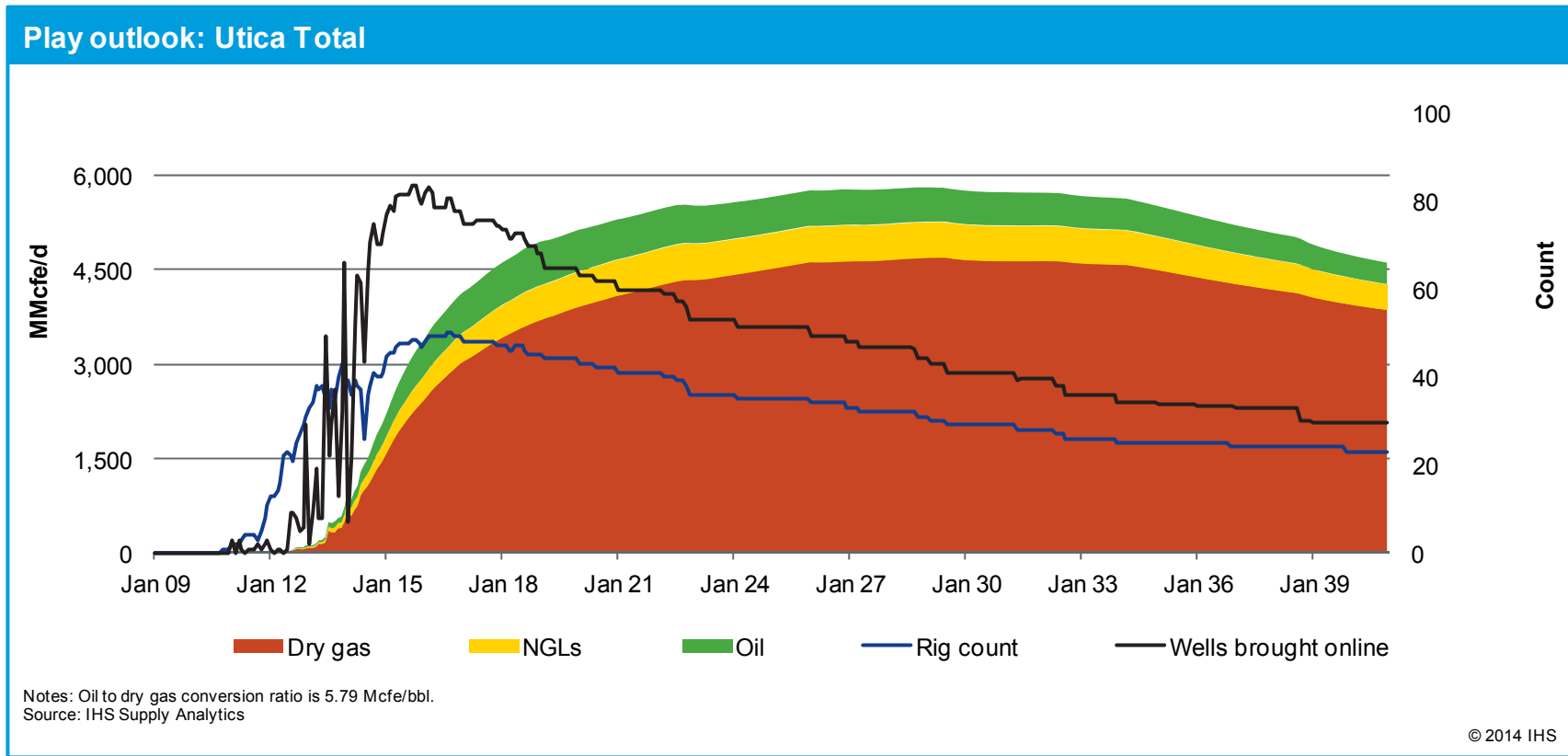


# Utica dry gas: Vintage type curves and peak rate evolution



	2012	2013
EUR gas (MMcf)	7,604	8,491

# Utica total: Production is expected to peak around 5.4 Bcfe/d in 2020



## Baseline pipeline expansions in IHS GPCM model

Project	ISD	MMcf/d	Census Region	
			Start	End
REX Seneca Lateral	2014	600	East North Central	East North Central
TCO Smithfield III	2014	444	Middle Atlantic	East South Central
TETCO TEAM 2014 Expansion (NY/NJ Delivery)	2014	300	Middle Atlantic	Middle Atlantic
TETCO TEAM South	2014	300	Middle Atlantic	East South Central
TETCO TEAM 2014 Expansion (ELA/WLA Delivery)	2014	250	Middle Atlantic	West South Central
REX East to West	2015	1,200	East North Central	East North Central
TGP Broad Run Flexibility Project	2015	590	South Atlantic	West South Central
TETCO OPEN	2015	550	East North Central	West South Central
Transco Leidy Southeast	2015	525	Middle Atlantic	East South Central
TCO East Side Expansion Project	2015	312	Middle Atlantic	Middle Atlantic
Transco Virginia Southside Expansion	2015	270	Middle Atlantic	South Atlantic
ET Rover Pipeline (OH del)	2016	750	Middle Atlantic	East North Central
TGT OH-LA Access Project	2016	626	East North Central	West South Central
Algonquin Incremental Market (AIM)	2016	342	Middle Atlantic	New England
Transco Atlantic Sunrise	2017	1,700	Middle Atlantic	South Atlantic
TCO Leach XPress Project	2017	1,500	Middle Atlantic	East South Central
ET Rover Pipeline (Mich/Dawn del)	2017	1,300	Middle Atlantic	Eastern Canada
TGP SW LA Supply Project	2017	1,000	Middle Atlantic	West South Central
NEXUS Gas Transmission	2017	1,000	East North Central	Eastern Canada
<b>Total</b>		<b>13,559</b>		

*Note: Lists key pipeline expansions (>250 MMcf/d) modeled in GPCM, but not an inclusive list*

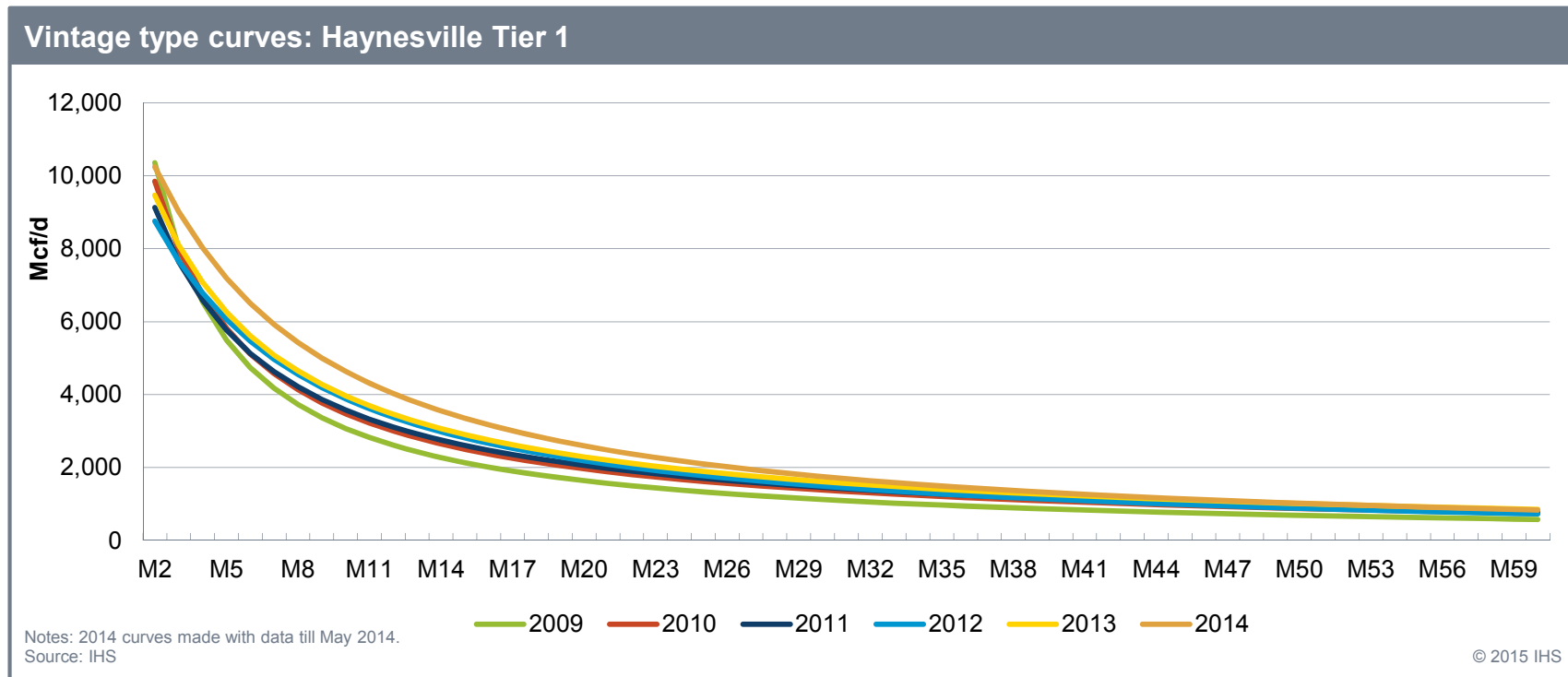
## Selected Incremental pipeline expansions on offer

Project	ISD	MMcf/d	Census Region	
			Start	End
TGP South System Flexibility Project	2016	500	East South Central	West South Central
Spectra Atlantic Bridge Project	2017	100	Middle Atlantic	New England
TGP Northeast Energy Direct	2018	800	Middle Atlantic	New England
REX Clarington West	2017	2,400	East North Central	West North Central
Prairie State Pipeline	2017	1,200	East North Central	East North Central
Atlantic Coast Pipeline	2018	1,500	South Atlantic	South Atlantic
<b>Total</b>		<b>6,500</b>		

### Summary MMcf/d

Base Case Total	13,559
Overbuild Total	20,059
<b>Incremental Build</b>	<b>6,500</b>

## Vintage type well decline curves



	2009	2010	2011	2012	2013	2014
Max rate: Gas (Mcf/d)	10,353	9,846	9,123	8,758	9,468	10,247
EUR gas (MMcf)	4,920	5,857	6,016	5,735	6,504	6,642

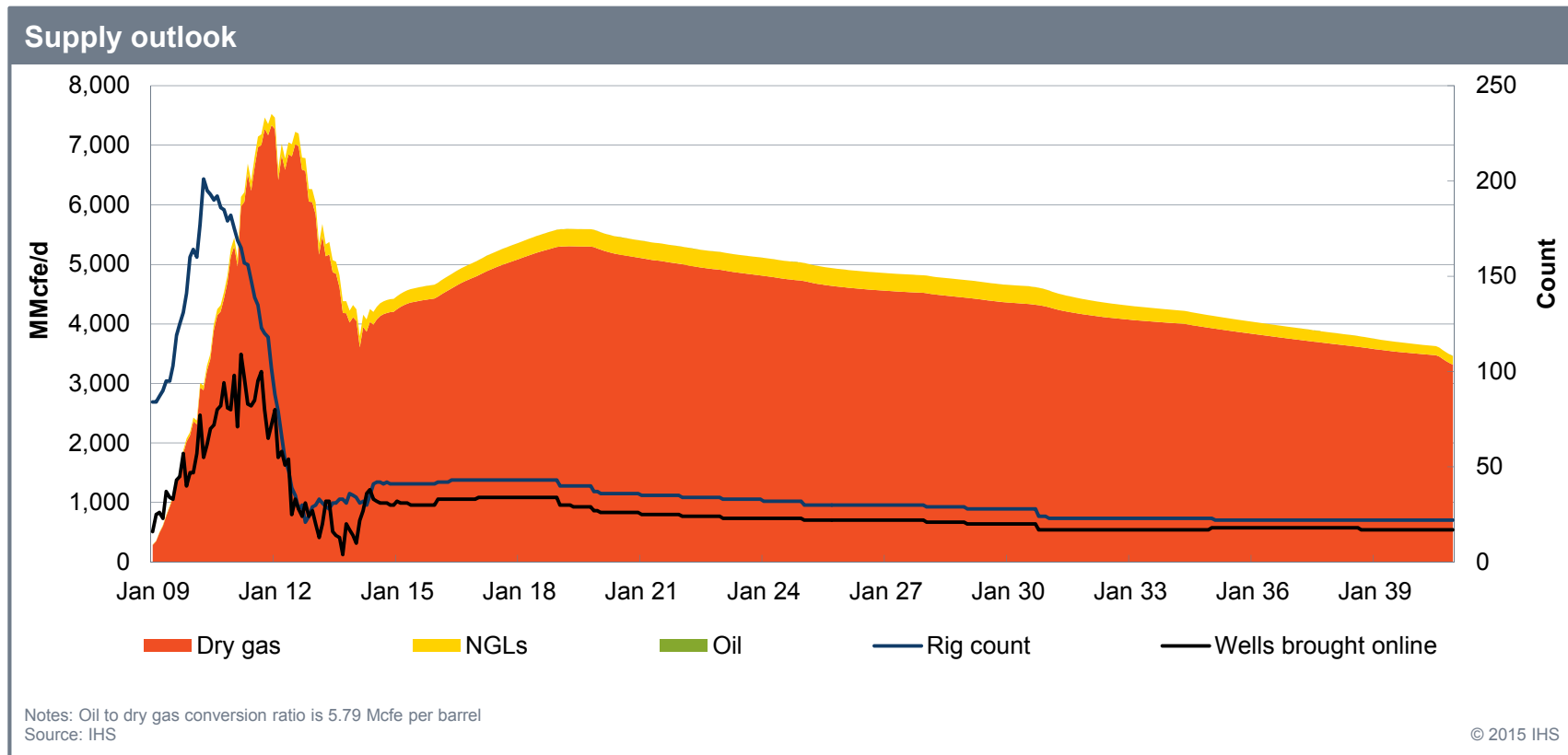
Source: IHS

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- Selected operators initiated a practice of choking back wells in 2010, which resulted in lower starting rates but shallower initial declines.

Note: EUR = estimated ultimate recovery.

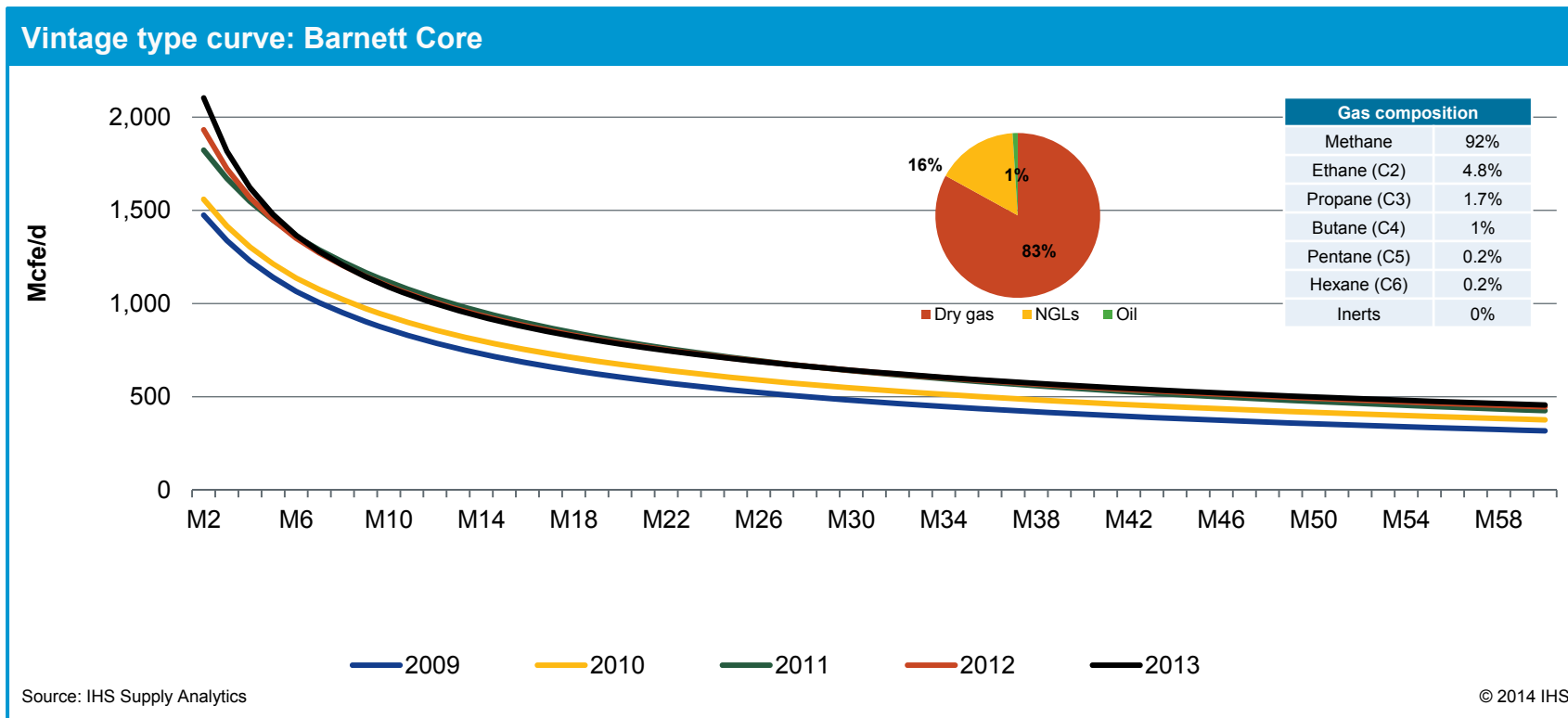
## Haynesville: Supply outlook



- Total production in the play is expected to plateau at 5.7 Bcf/d, lower than the play peaked at the end of 2011. With associated gas being produced from liquids-rich plays, we expect these levels to sustain and investments into the gas plays to continue where they are. Demand surges might have an impact on the overall supply outlook in the future.



# Barnett Core: Vintage type curves

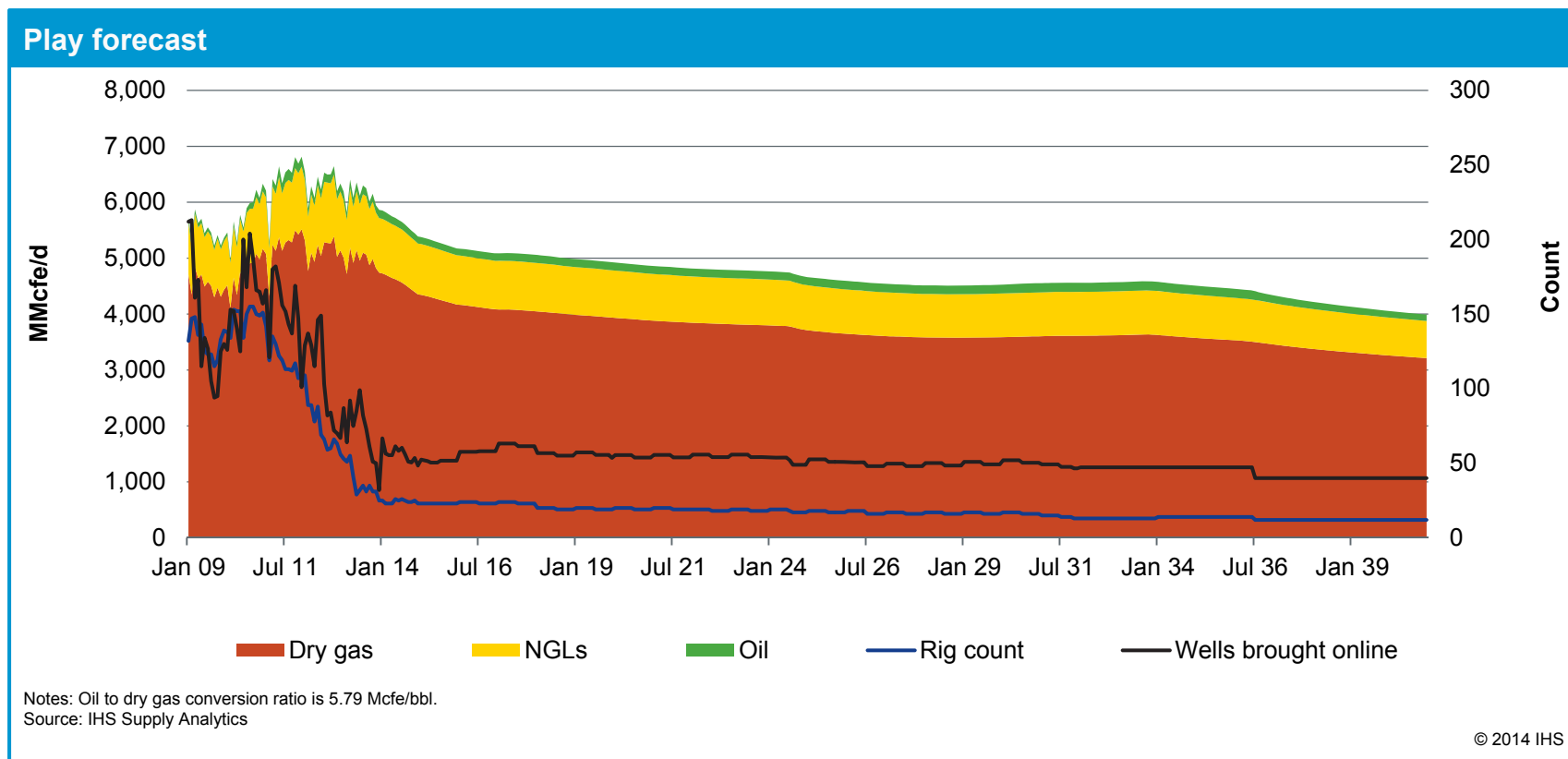


	2009	2010	2011	2012	2013
Maximum rate: Gas (Mcf/d)	1,474	1,560	1,823	1,932	2,105
EUR gas (MMcf)	2,059	2,440	2,730	2,910	3,025

- The top operators have increased the number of fracturing stages, which has led to improved well productivity.
- The jump in the 2011 curve compared with the 2010 curve can be credited to an increase in the number of fracturing stages and proppant use for Chesapeake, Devon Energy, and ExxonMobil, which together contribute more than 60% of the production from this subplay.

EUR = estimated ultimate recovery; Mcfe = thousand cubic feet equivalent.

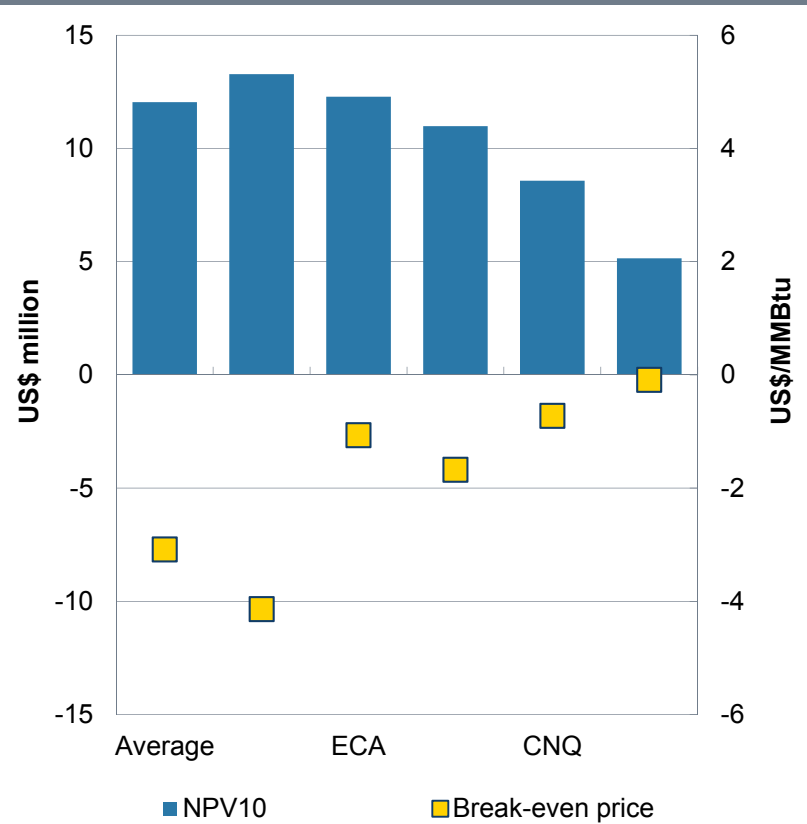
## Barnett Play total: Supply outlook



- Limited liquids content and low gas prices are expected to continue to curtail investments in the play.

# Montney Production Economics

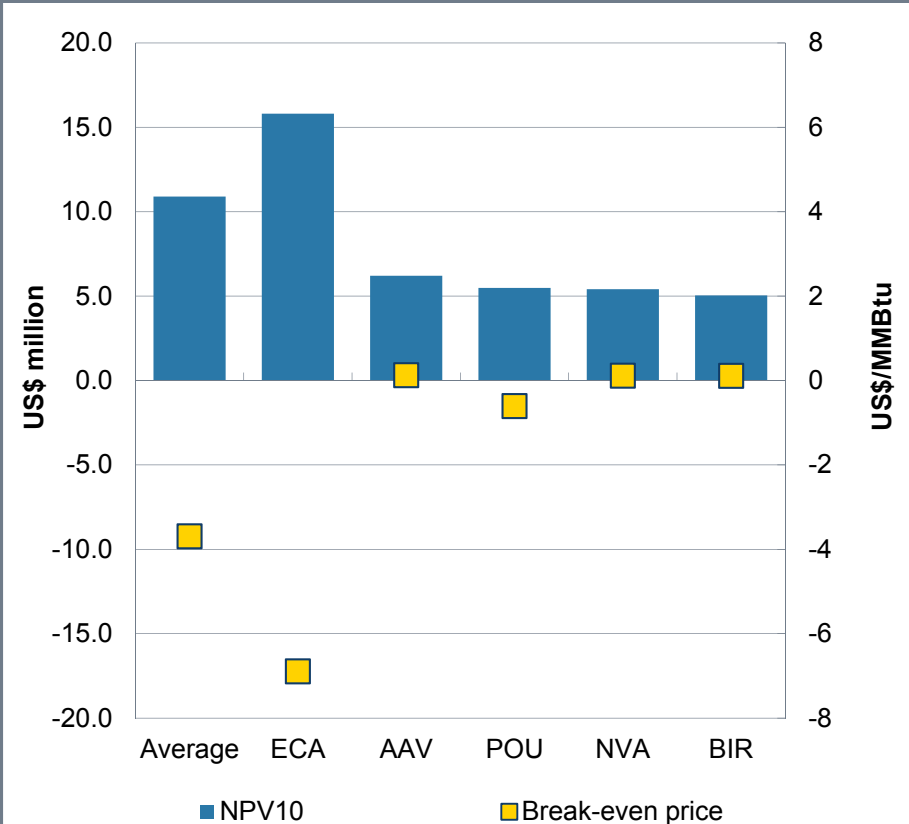
Montney BC Frontier Rich Gas: Single well economics



Notes: NPV10 is calculated with gas price at US\$3.5/MMBtu flat and oil price at US\$100/bbl flat.  
Source: IHS

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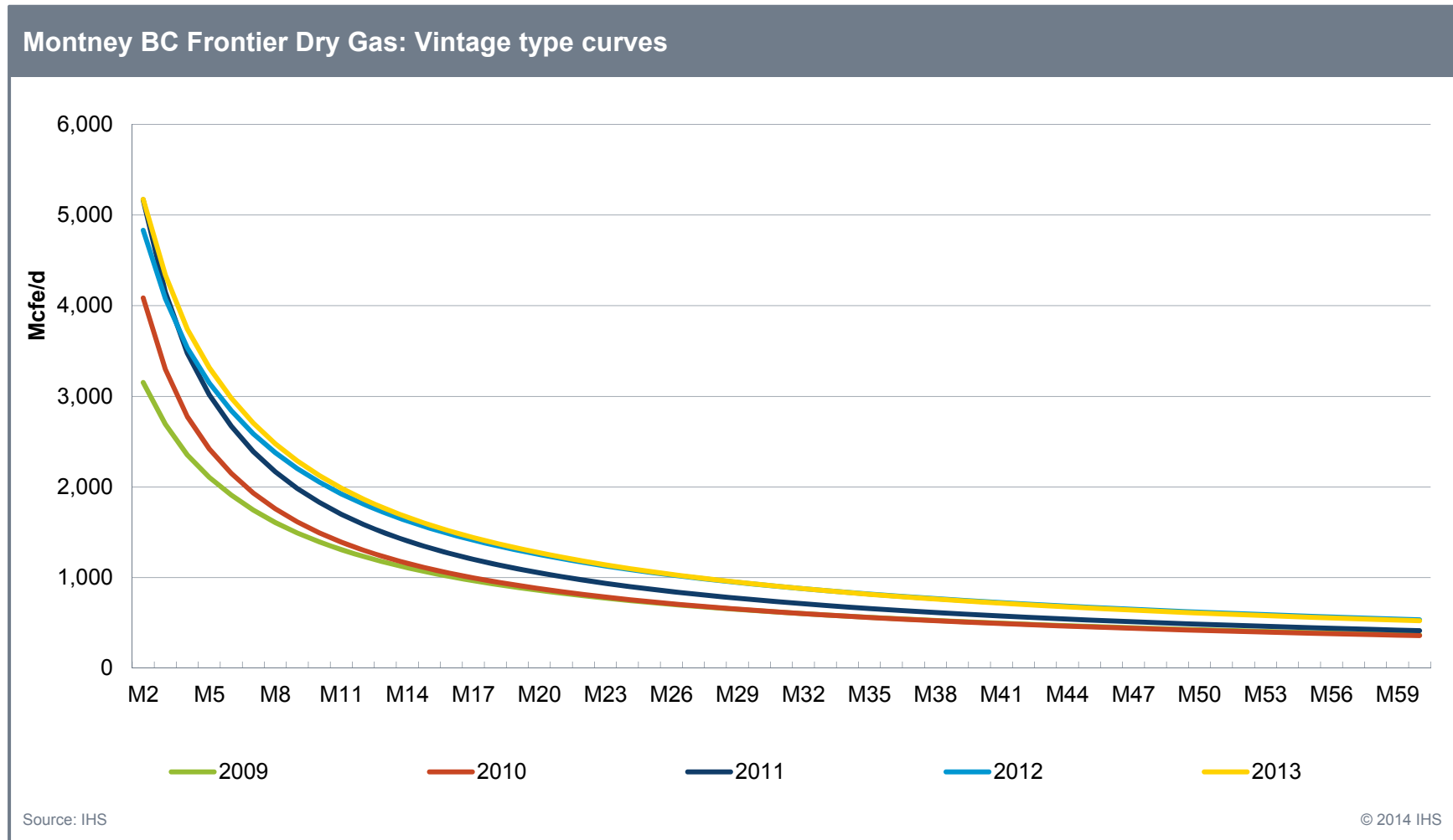
Montney AB Frontier: Single well economics



Notes: NPV10 is calculated with gas price at US\$3.5/MMBtu flat and oil price at US\$100/bbl flat.  
Source: IHS

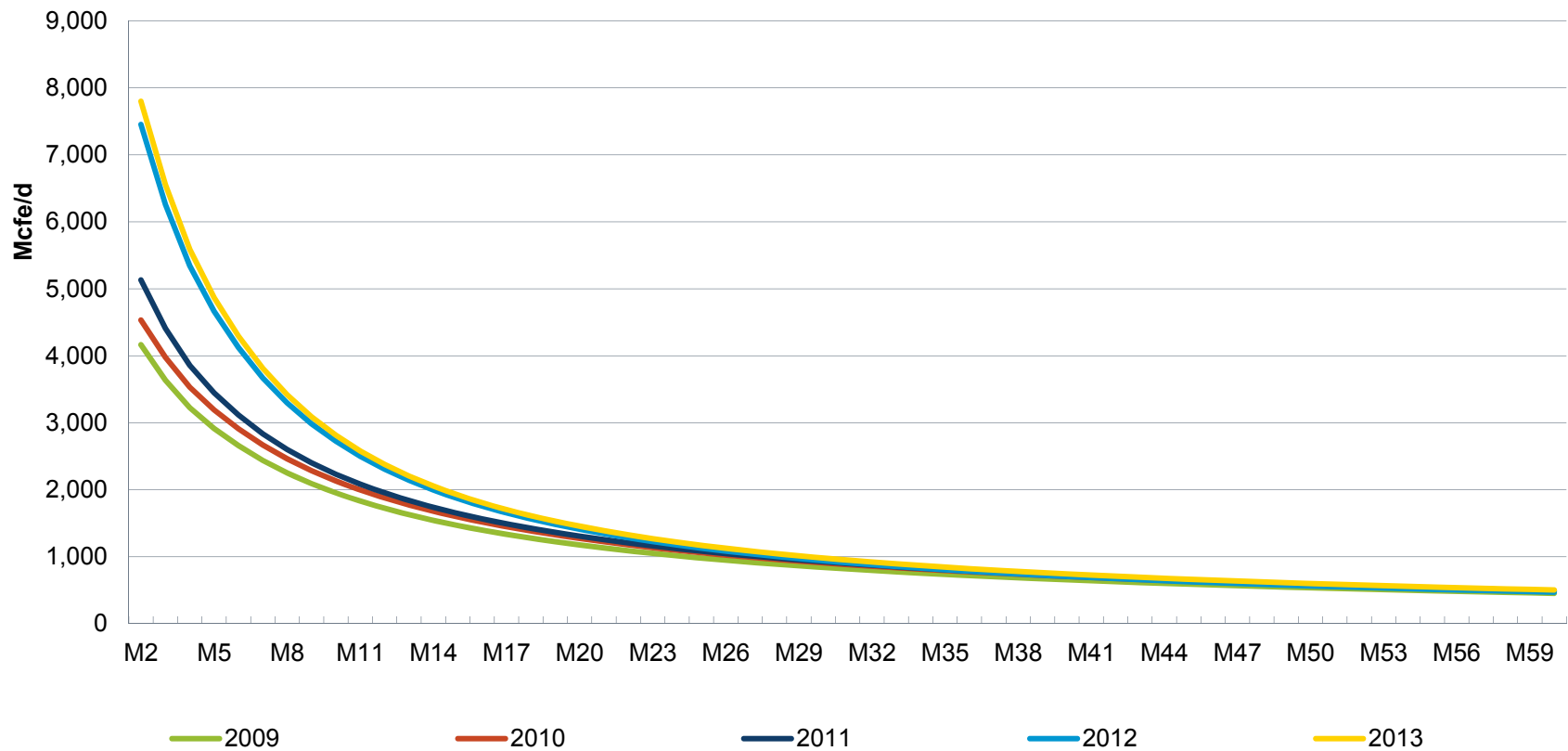
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# Montney Production



# Montney Production

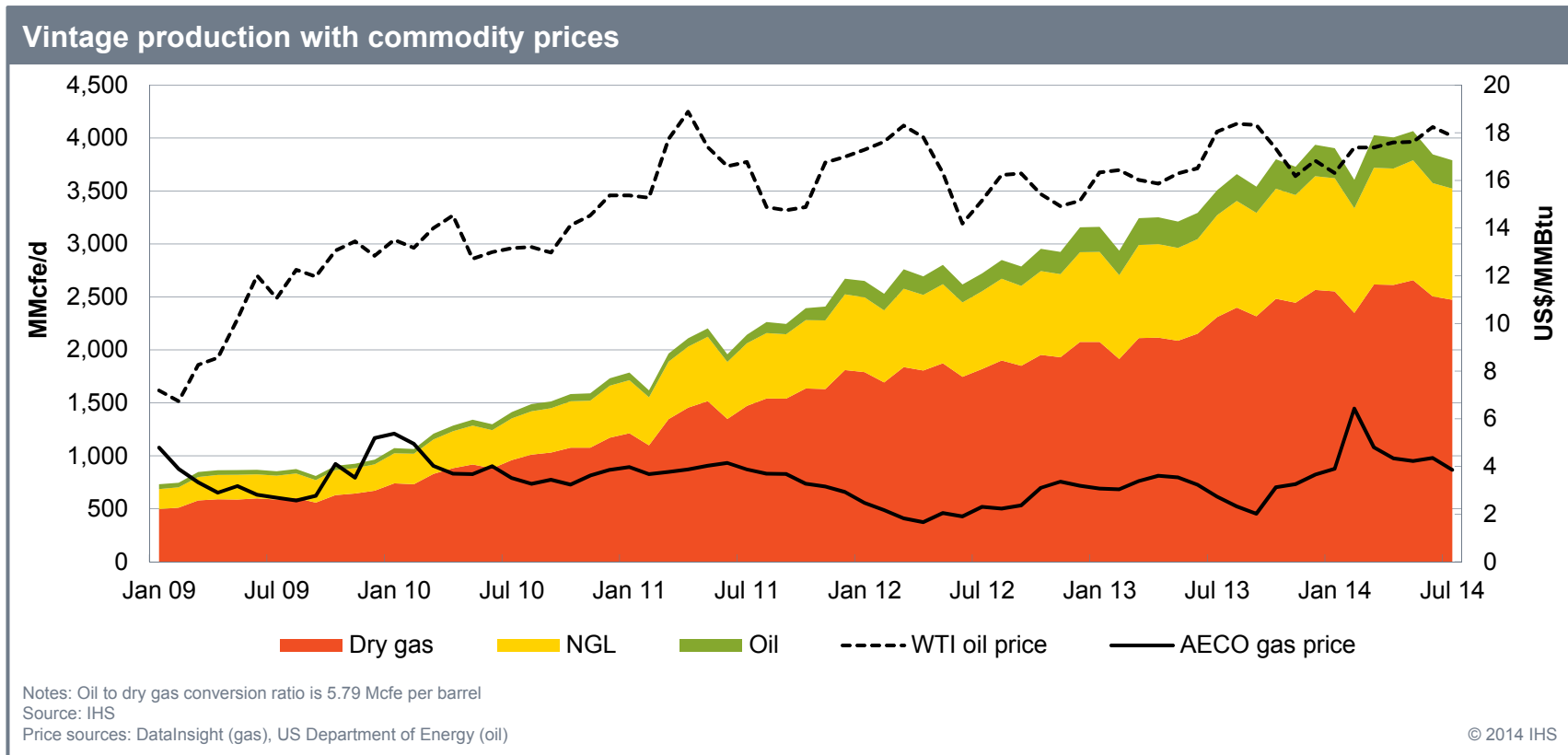
Montney AB Frontier: Vintage type curves



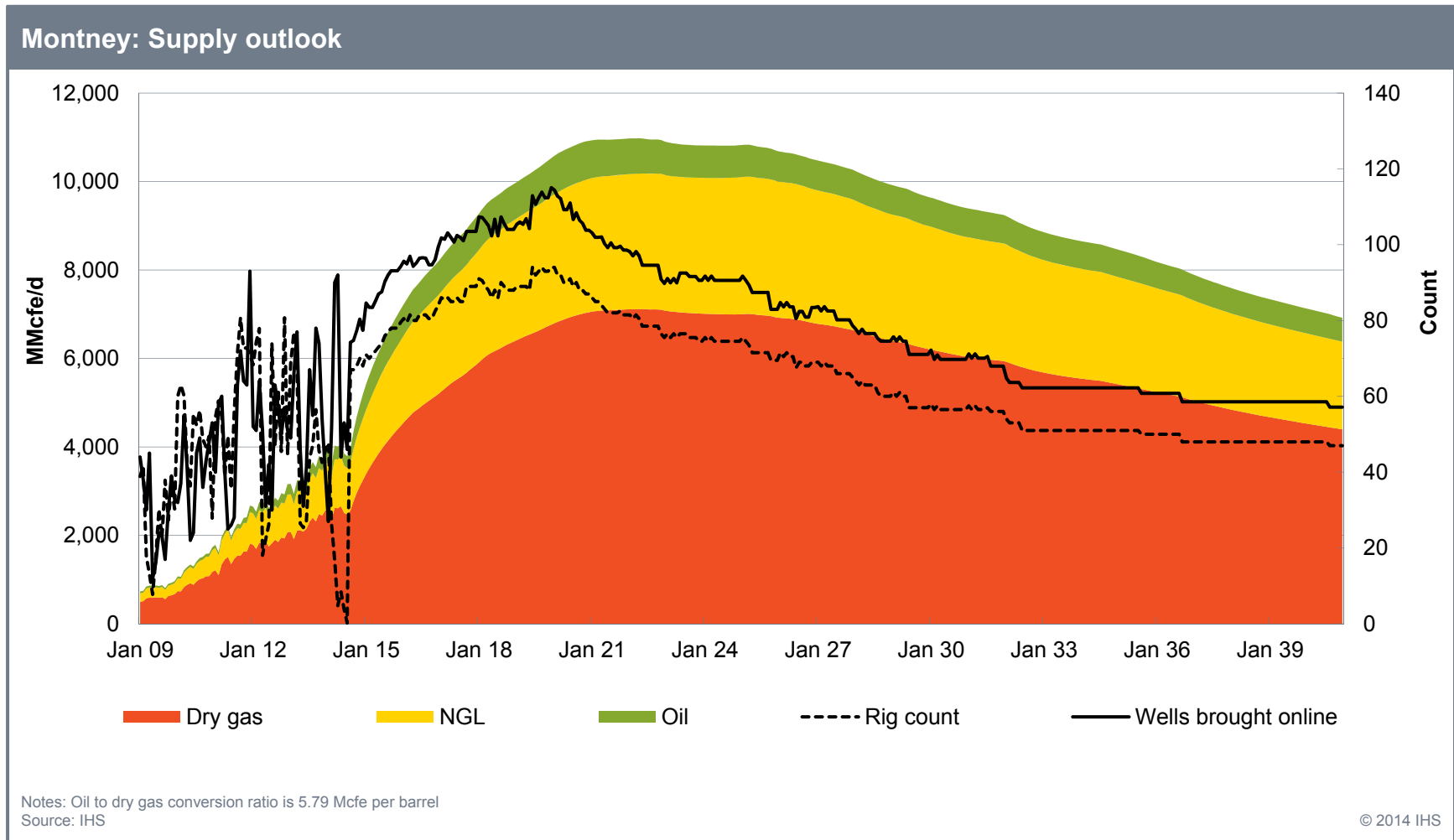
Source: IHS

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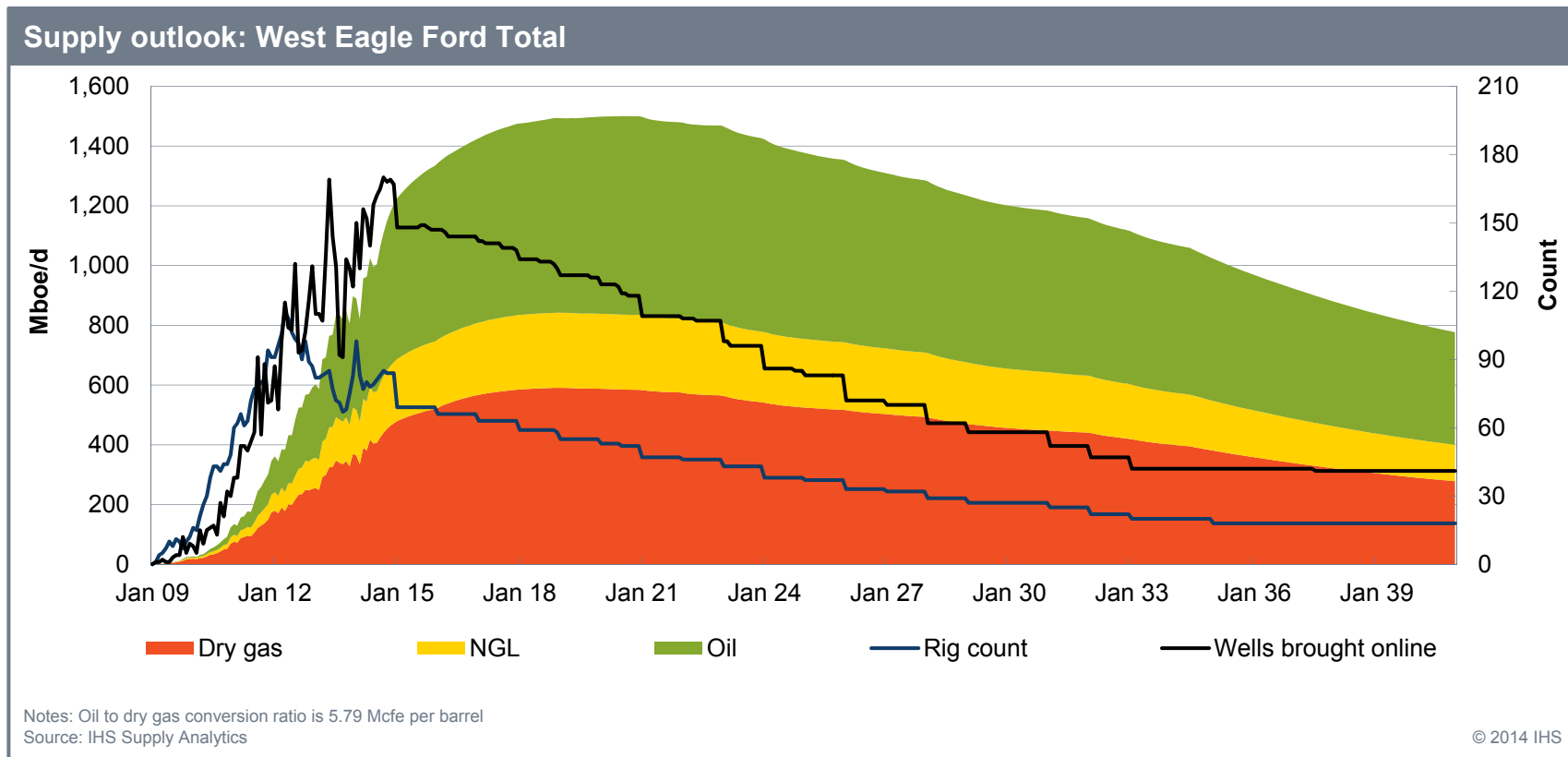
# Montney Production History and Commodity Prices



# Montney Production and Outlook



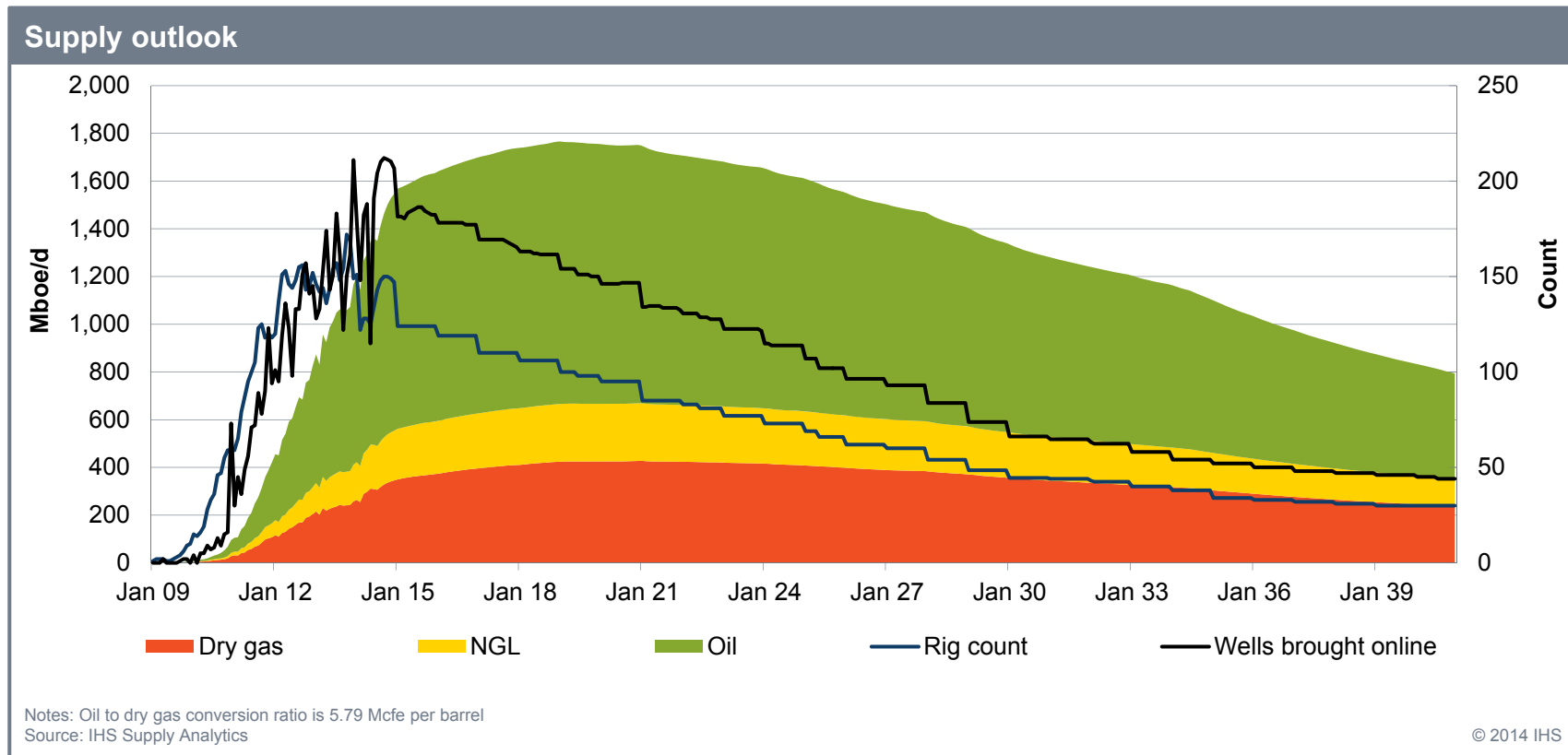
# Eagle Ford West: Supply outlook



- Production is expected to peak in December of 2020 with 1.5 million barrels of oil equivalent.
- Oil and gas production from the Eagle Ford West was around 420,000 barrels per day (bbl/d) and 2.8 billion cubic feet per day (Bcf/d) as of June 2014 and is forecasted to reach 665,000 bbl/d and 4.8 Bcf/d by December 2020.

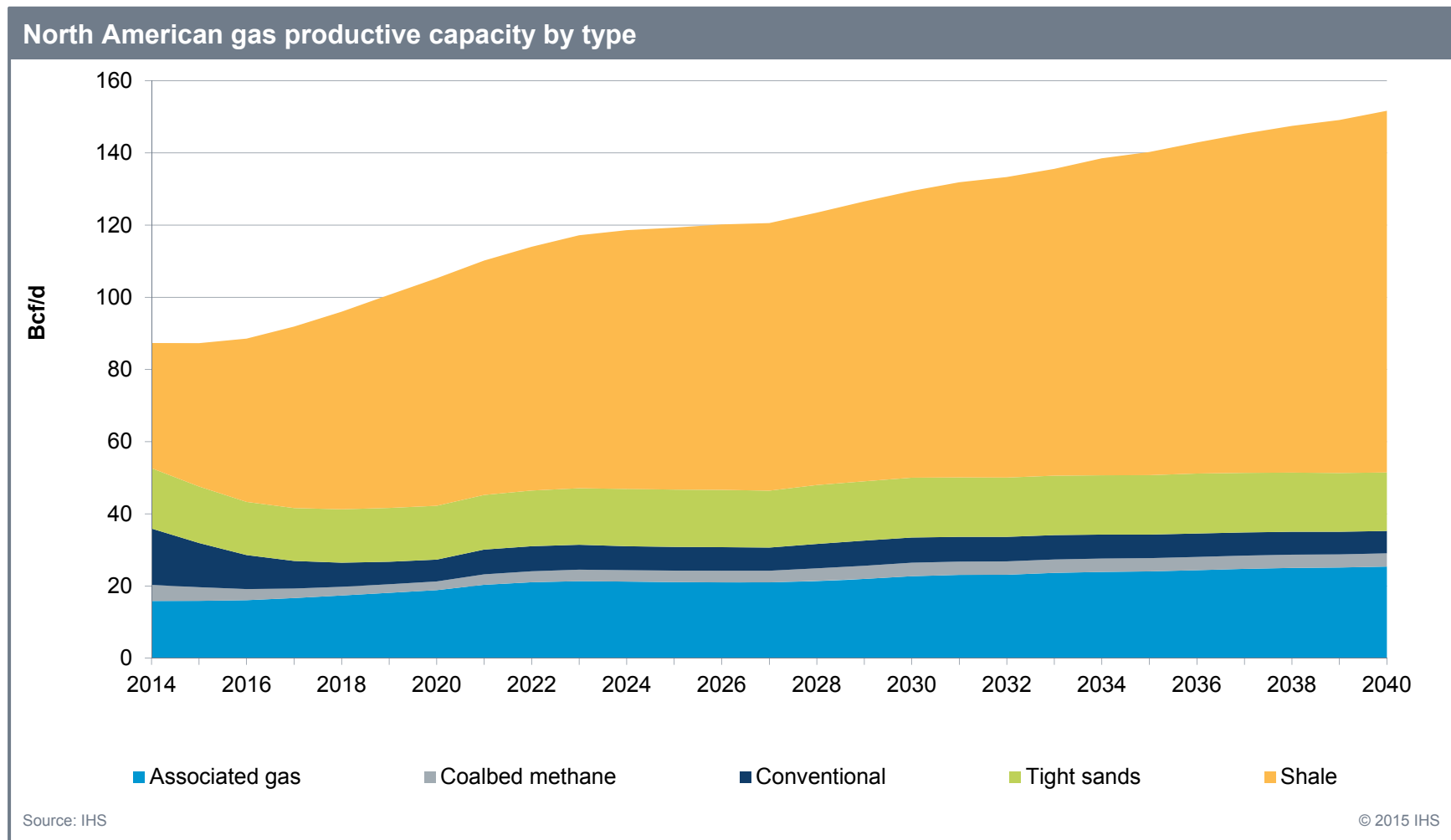


## Eagle Ford East: Supply outlook

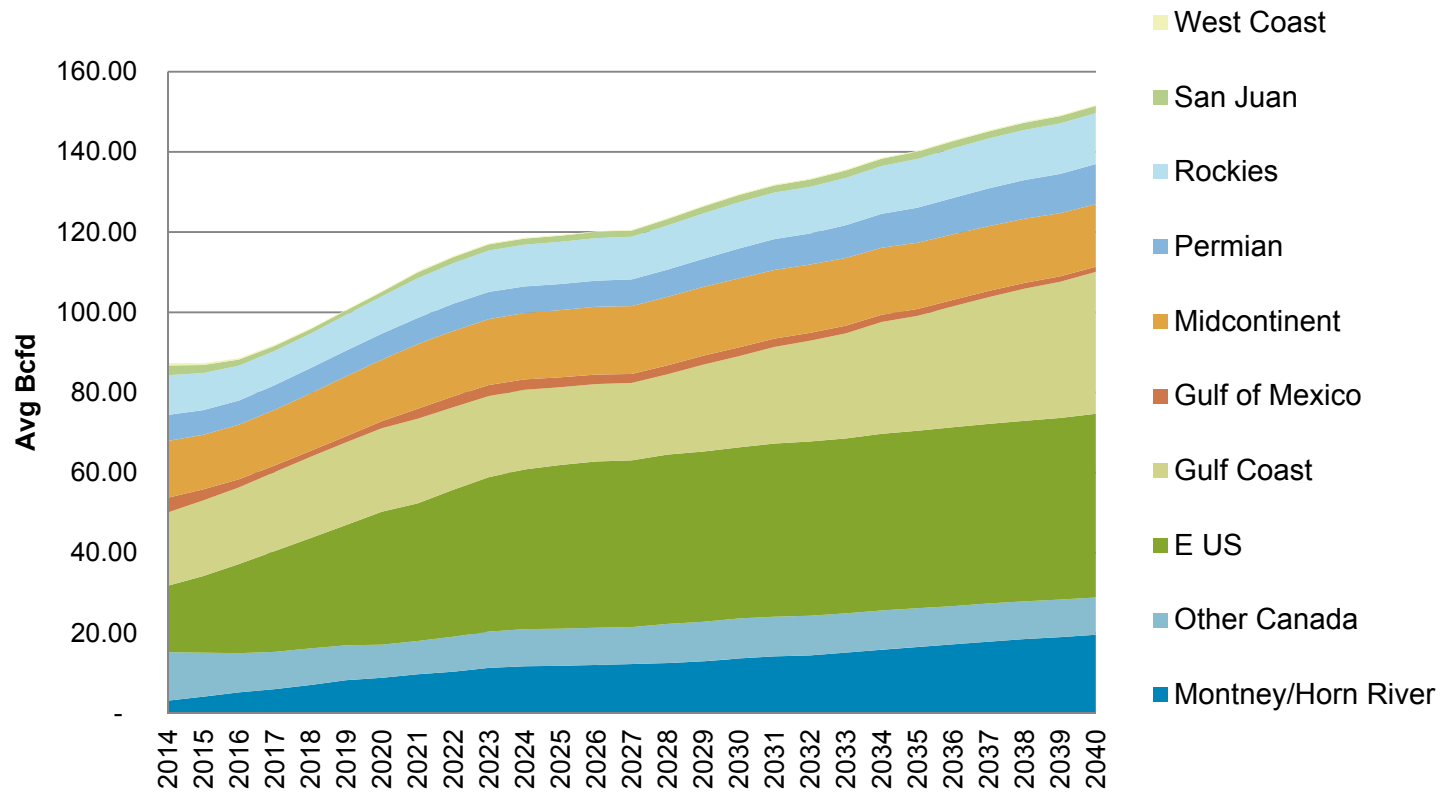


- Production from the Eagle Ford East was 870,000 barrels per day (b/d) and 2.3 billion cubic feet per day Bcf/d as of June 2014. Production exit rate is expected to be around 1.16 million barrels per day (MMbbl/d) and 4.1 Bcf/d by Dec 2018.
- Production is expected to peak in December of 2018 with 1.9 million barrels of oil equivalent.

# North American gas productive capacity by type



# North American Gas Production Outlook (Matching Demand Growth) by Geography



# Storage and rapid demand growth lead to higher natural gas prices—for a while

