U.S. Geological Survey

USGS Releases New Assessment of Gas Resources in the Marcellus Shale, Appalachian Basin

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Contact Information:
U.S. Department of the Interior, U.S. Geological Survey
Office of Communications and Publishing
12201 Sunrise Valley Dr, MS 119
Reston, VA 20192

Brenda Pierce
Phone: 703-648-6421

James Coleman
Phone: 703-648-6400

Alex Demas
Phone: 703-648-4421

The Marcellus Shale contains about 84 trillion cubic feet of undiscovered, technically recoverable natural gas and 3.4 billion barrels of undiscovered, technically recoverable natural gas liquids according to a new assessment by the U. S. Geological Survey (USGS).

(#) These gas estimates are significantly more than the last USGS assessment of the Marcellus Shale in the Appalachian Basin in 2002, which estimated a mean of about 2 trillion cubic feet of gas (TCF) and 0.01 billion barrels of natural gas liquids.

(#) The increase in undiscovered, technically recoverable resource is due to new geologic information and engineering data, as technological developments in producing unconventional resources have been significant in the last decade. This Marcellus Shale estimate is of unconventional (or continuous-type) gas resources.

(#) (#) 65 (#) Since the 1930's, almost every well drilled through the Marcellus found noticeable quantities of natural gas. However, in late 2004, the Marcellus was recognized as a potential reservoir rock, instead of just a regional source rock, meaning that the gas could be produced from it instead of just being a source for the gas. Technological improvements resulted in commercially viable gas production and the rapid development of a major, new continuous natural gas and natural gas liquids play in the Appalachian Basin, the oldest producing petroleum province in the United States.

This USGS assessment is an estimate of continuous gas and natural gas liquid accumulations in the Middle Devonian Marcellus Shale of the Appalachian Basin. The estimate of undiscovered natural gas ranges from 43.0 to 144.1 TCF (95 percent to 5 percent probability, respectively), and the estimate of natural gas liquids ranges from 1.6 to 6.2 billion barrels (95 percent to 5 percent probability, respectively). There are no conventional petroleum resources assessed in the Marcellus Shale of the Appalachian Basin.

These new estimates are for technically recoverable oil and gas resources, which are those quantities of oil and gas producible using currently available technology and industry practices, regardless of economic or accessibility considerations. As such, these estimates include resources beneath both onshore and offshore areas (such as Lake Erie) and beneath areas where accessibility may be limited by policy and regulations imposed by land managers and regulatory agencies.

http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/Economic_Value_Estimates.pdf

MDE

Estimated Marcellus Shale Natural Gas Value
Garrett County, Maryland

Assumptions:	
Drillable Acreage in Garrett Co.	128,000
Acres per well	80
Number of wells	1600
Extractable Gas	
Minimum tcf	1
Maximum tcf	8
Life of Well (years)	50
Royalty	12%
Price of Gas/mmcf	$3.93
Price of Gas/tcf	$3,930,000,000
Severance Tax	5.50%

Estimated Lifetime Value:	
Total Play Revenue	
Minimum	$3,930,000,000
Maximum	$31,440,000,000
Average per Well Revenue	
Minimum	$2,456,250
Maximum	$19,650,000
Average Total Royalty Payment per Well	
Minimum	$294,750
Maximum	$2,358,000
Total Severance Tax	
Minimum	$216,150,000
Maximum	$1,729,200,000

Estimated Annual Value:	
Total Play Revenue	
Minimum	$78,600,000
Maximum	$628,800,000
Average per Well Revenue	
Minimum	$49,125
Maximum	$393,000
Average Royalty Payment per Well	
Minimum	$5,895
Maximum	$47,160
Average Severance Tax	
Minimum	$4,323,000
Maximum	$34,584,000

resource within each state,[13] Maryland is estimated to have the following amounts of technically recoverable natural gas at the 95%, 50% and 5% confidence levels.

Estimated Marcellus Shale Gas Resource in Maryland			
	F95[14] - Min	F50	F5 - Max
Natural Gas (billion cubic feet)	711	1,302	2,383

The new USGS estimate of the volume of recoverable gas in Maryland is lower than some other estimates.[15]

A large amount of uncertainty still exists in estimates of the amount of gas recoverable from the formation, and the future price of natural gas. Using the USGS estimates and assuming a constant price of $3.93 per million cubic feet,[16] each 1% of severance tax on Marcellus Shale gas is estimated to result in revenues ranging between $27.9 million and $93.7 million over the lifetime of the gas extraction. Assuming a 50 year lifetime of the Marcellus play in Maryland, the average annual receipts per 1% of severance tax range from $559K to $1.9M; at a 50% confidence level, $1M.

	F95 - Min	F50	F5 - Max
Total Play Value Over 50 Years	$ 2,794,325,499	$ 5,115,416,118	$ 9,365,344,842
Total Receipts Over 50 Years per 1% of Severance Tax	$ 27,943,255	$ 51,154,161	$ 93,653,448
Average Annual Receipts per 1% of Severance Tax	$ 558,865	$ 1,023,083	$ 1,873,069

The actual annual severance tax receipts would depend on the pace of drilling and the production curve of the wells. The total amount will be realized only if all the technically recoverable gas is produced and sold. Some portion of that gas will not be recovered in practice.[17]

[13] Coleman, J.L., *et al.*, USGS Re-Assessment of the Undiscovered, Technically Recoverable Oil and Gas Resources of the Marcellus Shale, Appalachian Basin, USA. PowerPoint presentation, MD-DE-DC Water Science Center, U.S. Geological Survey, Baltimore, MD. (October 21, 2011).

[14] F95 represents a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly.

[15] The USGS minimum is less than half, and the maximum is less than 20%, of the volume estimated by a representative of Samson Resources and used as a basis for calculations by an extension agent. UMD Extension Agent, Estimated Marcellus Shale Natural Gas Value, http://marcellusshale.garrettcounty.org/images/documents/Economic%20Value%20Estimates.pdf.

[16] This is the same price for wellhead natural gas used by the extension agent.

[17] Some gas may be inaccessible for a variety of reasons, such as the unwillingness of an owner to lease mineral rights.

EIA

The 750 trillion cubic feet of shale gas resources in the INTEK shale report is a subset of the *AEO2011* onshore Lower 48 States natural gas shale technically recoverable resource estimate of 862 trillion cubic feet. The *AEO2011* includes 35 trillion cubic feet of proved reserves reported to the Securities and Exchange Commission (SEC) and the EIA, 20 trillion cubic feet of inferred reserves not included in the INTEK shale report, and 56 trillion cubic feet of undiscovered resources estimated by the USGS.

Table 1. INTEK estimates of undeveloped technically recoverable shale gas and shale oil resources remaining in discovered shale plays as of January 1, 2009

Onshore Lower-48 Oil and Gas Supply Submodule region	Shale play	Shale gas resources (trillion cubic feet)	Shale oil resources (billion barrels)
Northeast	Marcellus	410	--
	Antrim	20	--
	Devonian Low Thermal Maturity	14	
	New Albany	11	--
	Greater Siltstone	8	--
	Big Sandy	7	--
	Cincinnati Arch*	1	--
Subtotal		472	--
Percent of total		63%	--
Gulf Coast	Haynesville	75	--
	Eagle Ford	21	3
	Floyd-Neal & Conasauga	4	--
Subtotal		100	3
Percent of total		13%	14%
Mid-Continent	Fayetteville	32	--
	Woodford	22	--
	Cana Woodford	6	--
Subtotal		60	--
Percent of total		8%	--
Southwest	Barnett	43	--
	Barnett-Woodford	32	--
	Avalon & Bone Springs	--	2
Subtotal		76	2
Percent of total		10%	7%
Rocky Mountain	Mancos	21	--
	Lewis	12	--
	Williston-Shallow Niobraran*	7	--
	Hilliard-Baxter-Mancos	4	--
	Bakken	--	4
Subtotal		43	4
Percent of total		6%	15%
West Coast	Monterey/Santos	--	15
Subtotal		--	15
Percent of total		--	64%
Total onshore Lower-48 States		750	24

*Note: From previous EIA estimates and thus not assessed in the INTEK shale report.
Subtotals and total may not equal sum of components due to independent rounding.