Potential Gas Committee

Potential Gas Agency
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Press Release

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POTENTIAL GAS COMMITTEE REPORTS RECORD FUTURE SUPPLY OF NATURAL GAS IN THE U.S.

GOLDEN, COLORADO — The Potential Gas Committee (PGC) today released the results of its latest biennial assessment of the nation's natural gas resources, which indicates that the United States possesses a total mean technically recoverable resource base of 3,374 trillion cubic feet (Tcf) as of year-end 2018. This is the highest resource evaluation in the Committee's 54-year history, exceeding the previous high assessment (from year-end 2016) by 557 Tcf (increase of about 20%). This is also the largest two-year increase in absolute resources between evaluations in the PGC history. The increase resulted from reassessments of shale gas resources in the Atlantic and Mid-Continent areas and conventional and tight gas in the Mid-Continent and Rocky Mountain areas.

"This seventh consecutive record-high resource evaluation by the PGC confirms that the U.S. has an abundance of natural gas. These resources are present in various reservoirs both onshore and offshore," said Dr. Alexei V. Milkov, Professor of Geology and Geological Engineering and Director of the Potential Gas Agency (PGA) at the Colorado School of Mines. PGA provides guidance and technical assistance to the PGC.

The PGC's year-end 2018 assessment of 3,374 Tcf includes 3,218 Tcf of gas potentially recoverable from "traditional" reservoirs (conventional, tight sands, carbonates, and

shales) and 157 Tcf in coalbed gas reservoirs. Compared to year-end 2016, traditional resources increased by 559 Tcf (21%), while coalbed gas resources decreased by about 2 Tcf. Accompanying Table 1 summarizes the national resource assessment for year-end 2018 and acknowledges changes from the previous year-end 2016 assessment.

PGC assesses technically recoverable resources and does not consider a specific price or schedule for the discovery and production of gas. The U.S. Energy Information Administration (EIA) of the U.S. Department of Energy (DOE) estimates the proved gas reserves, which are additional to the resources assessed by PGC. When the PGC's assessments of technically recoverable resources are combined with EIA's latest determination of proved reserves (464 Tcf of natural gas as of year-end 2017), the U.S. future supply of natural gas stands at a record 3,838 Tcf, an increase of 697 Tcf (22%) over the previous evaluation.

Dr. Milkov highlighted that, "More well drilling and continuous improvements in completion and stimulation technologies lead to better delineation and characterization of U.S. gas resources, especially in shale and tight reservoirs. The record gas resources assessed by the PGC, in addition to record reserves and production reported by EIA, display a picture of strong supply of natural gas in the U.S. for many years to come."

PGC reports the potential resources at the national level as well as for seven individual geographic areas and 90 geological provinces. Such detailed area-level and province-level results offer great value for purposes of analysis, planning and exploration.

The Atlantic area ranks as the country's richest resource area with 41% of total U.S. traditional resources, followed by the Mid-Continent with 19%, the Gulf Coast (including the Gulf of Mexico) with 16% and Rocky Mountains with 16%. Changes in the total assessment from year-end 2016 to year-end 2018 (see accompanying Table 2) arose primarily from the evaluation of recent drilling, well-test and production data from these four areas.

The largest volumetric gains (264 Tcf or 25%) were reported in the Atlantic area. The major reason for the increase is new drilling and production results from Marcellus and Utica shale plays in the Appalachian basin.

Mid-Continent assessments rose by 245 Tcf (66%), reflecting intensive developments of conventional, tight and shale reservoirs in the Permian Basin. In its resource evaluation, PGC accounted for additional zones and potential well locations associated with stacked pays recently developed in this area.

Gas resources in the Rocky Mountain area increased by 65 Tcf (15%). This resource growth reflects large revisions in the Williston Basin and the Denver Basin. Specifically, PGC more rigorously accounted for the gas associated with production of liquids in those basins.

The Gulf Coast area had a modest overall decrease of 22 Tcf (4%). The main reason for reduction was downsizing of the type well in the Eagle Ford play, and lack of resource additions to replace production from the Eagle Ford and the Haynesville shale plays.

The importance of shale gas in the USA is evidenced by the fact that the PGC's mean total assessed shale gas resource of 2,107 Tcf for year-end 2018 accounts for approximately 62% of the country's total potential resources. The growth of shale gas resources from year-end 2016 to year-end 2018 was 310 Tcf (17%).

PGC's assessment results are presented in the report *Potential Supply of Natural Gas in the United States (December 31, 2018)*. The first chapter of the report includes a complete review of the national aggregated mean value assessment statistics (summarized in tables and figures), together with an area-by-area comparison of assessment results for year-end 2016 and 2018 and decennial changes in area-level assessments from 2008 to 2018. The second chapter examines the 2018 evaluations at the area and province levels and discusses the factors behind the changes in assessments between 2016 and 2018. Also included are graphs for each area that track historical trends in the Committee's "most likely" (non-aggregated) assessments since 1984, as well as trends in the aggregated mean values since 1990. The concluding chapter presents definitions and details of the PGC's resource assessment methodologies, as well as statistical tabulations of all non-aggregated area- and national-level assessments.

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Details of the Potential Gas Committee's Natural Gas Resource Assessment (as of December 31, 2018)

The PGC reports its biennial potential gas resource assessments in three categories of decreasing geological certainty - Probable, Possible and Speculative. For each category, a minimum, most likely and maximum volume is assessed in each of 90 onshore and offshore provinces in the Lower 48 States and Alaska. The category and total mean values shown in Table 1 below were computed by statistical aggregation of the minimum, most likely and maximum value distributions for each category and for all provinces combined. This procedure allows for more direct comparison of PGC's assessments with those made by other organizations.

The PGC's assessments are not static. Based on new exploration results, drilling and production information and various other data that become available, PGC members may reclassify resources at the province level from one category to another and to proved reserves.

Table 1. Summary of year-end 2018 nation-level resource assessment and comparison with the year-end 2016 assessment.

Resource Category	Mean Values (rounded), trillion cubic feet (Tcf)		Change from 2016 to 2018	
	2018	2016	Tcf	%
Traditional Gas Resources:				
- Probable resources (current fields)	1,120	994		
- Possible resources (new fields)	1,376	1,057		
- Speculative resources (frontier)	722	608		
- Total	3,218	2,658	+559	+21
Coalbed Gas Resources:				
- Probable resources (current fields)	15	15		
- Possible resources (new fields)	47	48		
- Speculative resources (frontier)	96	96		
- Total	157	159	-2	-1
Grand Total Potential Resources	**3,374**	**2,817**	**+557**	**+20**
Proved gas reserves (EIA)	464*	324*	+140	+43
U.S. Future Gas Supply	**3,838**	**3,141**	**+697**	**+22**

Notes:
* Total gas (dry and wet), latest available figure is for year-end 2017.

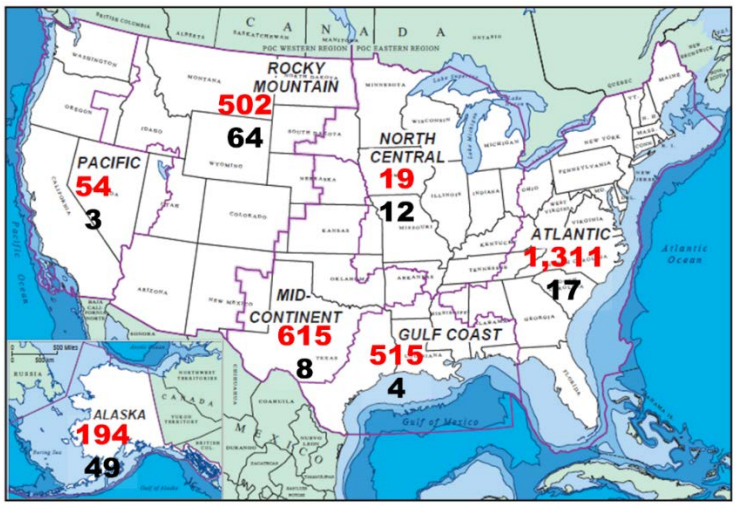
PGC's 90 geological provinces are grouped into seven geographic assessment areas. Table 2 compares the mean values of total traditional gas resources for these areas for year-end 2018 and year-end 2016.

Table 2. Summary of year-end 2018 area-level assessment of traditional gas resources (conventional, tight sands, carbonates, and shale reservoirs) and comparison with the year-end 2016 assessment.

Assessment Area	Mean Values (rounded), trillion cubic feet (Tcf)		Change from 2016 to 2018	
	2018	2016	Tcf	%
Total Traditional Gas Resources:				
- Atlantic	1,311	1,047	+264	+25
- Mid-Continent	615	370	+245	+67
- Gulf Coast (incl. Gulf of Mexico)	515	538	-22	-4
- Rocky Mountain	502	437	+65	+15
- Alaska	194	194	0	0
- Pacific	54	54	0	0
- North Central	19	19	0	0
Total U.S. Traditional Gas Resources	**3,218**	**2,658**	**+560**	**+21**

Figure 1 shows the assessment areas and summarizes the results of year-end 2018 assessment for both traditional and coalbed gas resources.

Figure 1. PGC assessment areas and the results of year-end 2018 assessments for mean traditional (red values) and coalbed (black values) gas resources (mean values).



All resource values reported above are mean values. However, PGC assessment of potential natural gas resources is probabilistic, and Table 3 shows the full range of assessed resources with associated probabilities.

Table 3. Probabilistic assessments of potential natural gas resources of the U.S. as of year-end 2018. P95 represents a 95-percent probability of at least the amount tabulated, and other P values are defined similarly.

Resource Category	Total Potential Resources (Tcf, rounded)					
	Min	**P95**	**P50**	**Mean**	**P5**	**Max**
Total U.S. Traditional Resources (Conventional / Tight / Shale)	2,459	2,813	3,204	3,218	3,673	4,080
Total U.S. Shale Gas Resources	1,348	1,711	2,093	2,107	2,556	2,917
Total U.S. Coalbed Gas Resources	101	130	157	157	181	207
Grand Total U.S. Resources	**2,603**	**2,969**	**3,360**	**3,374**	**3,830**	**4,235**

How to Obtain the Potential Gas Committee Report

Orders for the PGC's report, *Potential Supply of Natural Gas in the United States (December 31, 2018)*, may now be placed with the Potential Gas Agency, Colorado School of Mines, Golden, CO 80401-1887. The cost of the report is US$375 (plus applicable sales tax for Colorado orders). All purchasers will receive both the printed report and a digital version (PDF file) of the document.

For additional information about ordering the new and previous reports, please contact Dr. Alexei Milkov, Director, at the Potential Gas Agency, telephone 303-273-3887, fax 303-273-3574, or e-mail: amilkov@mines.edu.

This press release and the accompanying slide presentation are available for viewing and download at the PGC website, http://www.potentialgas.org.

About the Potential Gas Committee

The Potential Gas Committee (PGC) consists of ~80 knowledgeable and highly experienced volunteer members who work in the natural gas exploration, production, transportation and distribution industries and in technical services and consulting sectors. The PGC benefits from the input of respected technical advisors and observers from federal and state government agencies, academia, and various industry and research organizations in the United States. Although the PGC functions independently, the Potential Gas Agency (PGA) at the Colorado School of Mines provides the Committee with guidance, technical assistance, training and administrative support, and assists in member recruitment and outreach. The PGA receives financial support from prominent E&P companies, gas pipeline companies and distributors, trade associations and individuals.

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