

# Energy Analysis

EA 2015-02

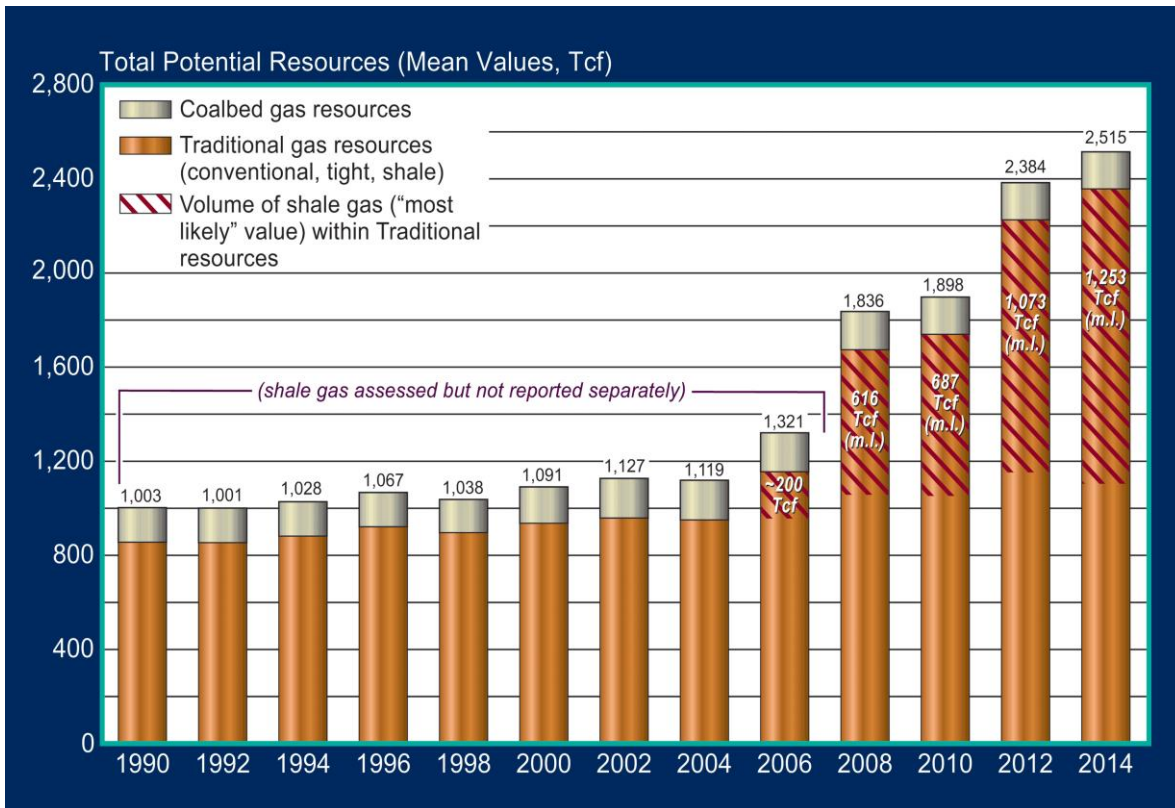
April 8, 2015

## Understanding Potential Supply of Natural Gas in the United States (Technically Recoverable Natural Gas Resources and Proved Reserves)

### US Natural Gas Technically Recoverable Resources

- The Potential Gas Committee (PGC) has estimated technically recoverable natural gas resources in the United States for 50 years. PGC estimates *do not* include proved reserves which are reported annually by the Energy Information Administration (EIA).
- For year-end 2014, the PGC assessment of domestic technically recoverable resources reached 2,515 trillion cubic feet (Tcf), which is 131 Tcf more (+6%) than the year-end 2012 reported value of 2,384 Tcf, remembering that nearly 50 Tcf of dry gas production occurred between the reporting dates and proved reserves grew, also.
- The total resource estimate of 2,515 Tcf includes 2,357 Tcf of so-called *traditional* resources (including shale gas) and 158 Tcf of *coalbed* gas resources (see Figure 1).
- Year-end 2014 marks the fifth consecutive report that a record-high resource evaluation has been presented by the Committee.
- Data is reported by region but separated into traditional resources and coalbed methane, while the contribution to traditional resources by shale gas is also identified. In fact, for the sequence of recently released reports, the shale gas estimate of 1,073 Tcf for year-end 2012 alone was larger than the entire resource estimate published at year-end 1990 (1,003 Tcf). See Figure 1.
- For year-end 2014 the shale-gas volume is even larger with resources of 1,253 assessed as technically recoverable.
- Including proved reserves (EIA), the future supply of natural gas identified from the Potential Gas Committee (technically recoverable resources) and the Energy Information Administration now exceeds 2,850 Tcf – the highest combined future supply of natural gas ever.

**Figure 1**



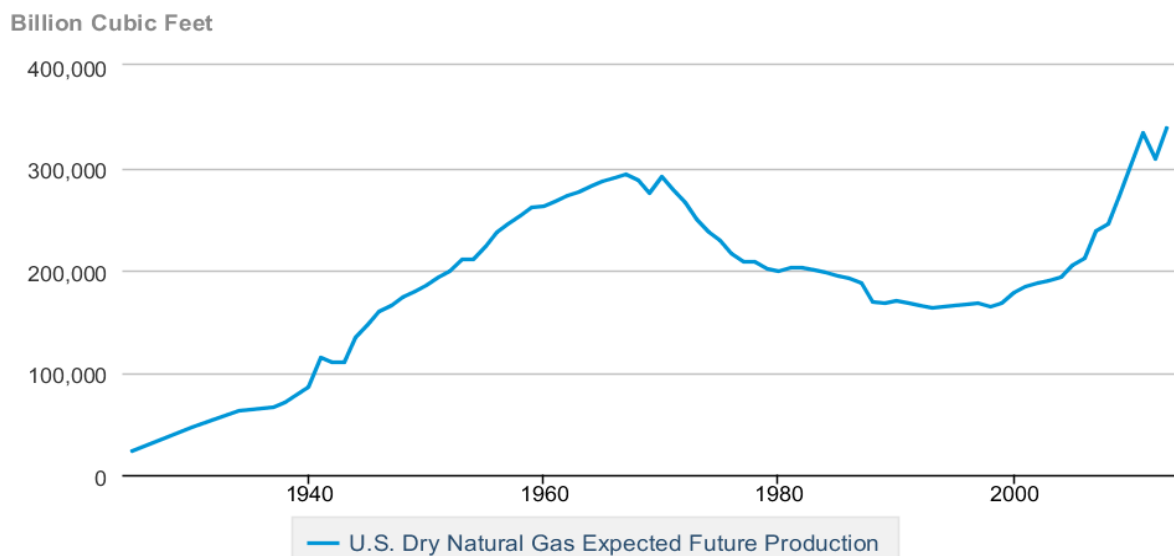
Source: Report of the Potential Gas Committee, Colorado School of Mines, April 2015.

**US Natural Gas Proved Reserves**

- Domestic proved natural gas reserves have grown significantly during the past 20 years. At about 170 Tcf in 1993, reserves are now estimated to be 338 Tcf (dry) or twice that volume.
- Proved reserves are those volumes of natural gas known to exist that have been proven by drilling (exploration and development activities) and therefore tend to be the foundation for current production capability. In Figure 2, EIA describes proved reserves as “U.S. Dry Natural Gas Expected Future Production.”
- EIA reserves estimates tend to lag the current year often by twelve months – sometimes more. In order to understand potential changes in reserves for the just past annual period (2014), AGA has examined the reporting of reserves to the Securities and Exchange Commission by 30 large reserves holders (primarily during the first quarter of 2015) and identified them in the following Table 1. In fact, AGA completes this exercise every year. By examining changes in reserves for 30 large US reserves holders it is possible to estimate changes in reserves for all producers for that year – in this case 2014.
- The first sense of whether reserves have grown or fallen based on drilling activities comes by comparing total revisions and improved recovery (1.1 Tcf in 2014) plus discoveries and extensions (19.5 Tcf) to that of total production (11.5 Tcf) for the sample of companies. If total additions (revisions, improved recovery, discoveries and extensions) exceed production, then reserves in total for the sample grew from the previous year, which is precisely what happened in this case.

Figure 2

## U.S. Dry Natural Gas Expected Future Production



 Source: U.S. Energy Information Administration

Source: Energy Information Administration, US Department of Energy, YE2013.

- Past history and comparison to Energy Information Administration data once the reserve accounting catches up with the preliminary AGA estimates has demonstrated over time that the AGA sample of 30 companies tends to account for one-third to one-half of all reserve additions for all producers in an annual period.
- If that is true, then reserve additions in 2014 for the whole country were about 38 to 62 Tcf based on the sample of 30 large reserves holders identified by AGA. Since production was in the mid-20s, reserves are anticipated to have grown once again – perhaps by 10 to 35 Tcf from year-end 2013 to year-end 2014.
- So even though domestic reserves for YE 2013 were the highest ever recorded for the United States at 338 Tcf (dry), AGA estimates that reserves grew once again in 2014 and likely exceed 345Tcf, conservatively estimated.

**Table 1**

**2014 CHANGES IN PROVED RESERVES**  
(BILLION CUBIC FEET)

<b>COMPANY</b>	<b>12/31/13 RESERVES</b>	<b>NET REVISIONS</b>	<b>IMPROVED RECOVERY</b>	<b>DISCOVERIES EXTENSIONS</b>	<b>SALES</b>	<b>PURCH.</b>	<b>12/31/14 PROD.</b>	<b>12/31/14 RESERVES</b>
ExxonMobil	26,301	54	0	1,519	314	60	1,361	26,259
Chesapeake Energy	11,734	-129	0	1,567	1,421	36	1,095	10,692
Southwestern Energy	6,974	542	0	1,691	0	1,367	765	9,809
Equitable Resources	7,562	-228	0	3,041	199	45	445	9,776
ConocoPhillips (2)	9,576	506	0	263	2	0	679	9,664
BP	9,947	-29	582	2	266	5	625	9,615
Anadarko	9,205	710	0	196	492	0	951	8,668
Devon Energy	8,550	-108	0	335	923	457	660	7,651
Cabot Oil and Gas	5,295	483	0	1,807	2	7	508	7,082
Range Resources	5,666	-30	0	1,393	81	263	287	6,923
Consol Energy	5,585	-31	0	980	0	0	216	6,318
BHP	6,056	-1,174	0	1,206	2	0	463	5,624
EOG Resources	4,399	252	0	638	52	17	348	4,906
Ultra Petroleum	3,410	-323	0	867	239	1,346	229	4,831
Linn Energy LLC	3,010	96	0	72	477	1,763	209	4,255
Chevron	3,990	76	2	614	53	1	456	4,174
WPX Energy	3,630	-198	0	362	315	6	335	3,150
Noble Energy, Inc.	2,656	58	0	433	154	0	189	2,804
QEP Resources	2,555	27	0	141	299	73	179	2,317
Encana	3,877	-511	0	493	1,473	234	355	2,265
Apache	2,673	36	0	203	521	21	216	2,197
Occidental	2,012	-111	284	27	371	46	171	1,714
Seneca Res. (NFG)	1,300	45	0	447	0	34	142	1,683
Pioneer Nat Res.	1,906	-3	0	276	360	3	154	1,669
Newfield Exploration	1,648	129	0	112	164	9	127	1,607
Exco Resources	1,016	288	0	70	106	7	121	1,155
Marathon	1,024	-24	0	290	39	5	113	1,144
Energen	720	-72	0	141	22	1	60	708
PDC Energy (1)	740	-149	0	203	237	1	19	537
Fidelity E & P (MDU)	198	36	0	64	40	8	21	245
<b>Total</b>	<b>153,215</b>	<b>218</b>	<b>868</b>	<b>19,453</b>	<b>8,624</b>	<b>5,815</b>	<b>11,499</b>	<b>159,442</b>

Sources: Securities and Exchange Commission Forms 10K AND 20F, 2014.

## References

*Potential Supply of Natural Gas in the United States – Report of the Potential Gas Committee*, Potential Gas Agency, Colorado School of Mines, April 2015.

*U.S. Crude Oil and Natural Gas Proved Reserves, 2013*; U.S. Energy Information Administration, U.S. Department of Energy, December 2014

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