Executive Summary

The Economic Analysis Methodology for the 2023-2028 National OCS Oil and Gas Leasing Program states: “Perhaps the most fundamental assumption in the development of the net benefits analysis and the National OCS Program analyses is that estimate of the anticipated production resulting from the various potential lease sales.” However, the Mid Level anticipated production estimate is disconnected from the reality of the published BOEM data. Specifically, that 5 years of leasing will results in more oil than 14 years of recent new field discoveries. Employing an anticipated production estimate that is consistent with the GOM OCS experience will yield a very small net benefit.

The body of the document is six pages. The analysis uses 19 years of tabular data from the reserves reports. That data is displayed in the appendix for ready reference.

Comments on Five Year Program

Introduction

The Economic Analysis Methodology for the 2023-2028 National OCS Oil and Gas Leasing Program states: “Perhaps the most fundamental assumption in the development of the net benefits analysis and the National OCS Program analyses is that estimate of the anticipated production resulting from the various potential lease sales.” However the Mid Level anticipated production estimate is not supported by the data. Assessing the quality of the anticipated production estimates is hard. An estimate is made, then decades will pass until the actual production occurs to see if that estimate is correlated with reality. This paper will examine the quality of the anticipated production estimates from three different perspectives. First a look back is made comparing the anticipated production estimates and the actual production that occurred. Next the discovery rate of finding new fields is examined. Finally the addition to Reserves from those new fields is compared to the anticipated production.

This paper will primarily look at GOM Planning Area 1 formally known as Central and Western GOM. Much of the data is from the GOM Reserves Reports which are appended for ready reference.

Look Back Analysis

About two decades ago MMS developed the Proposed Final Program (PFP) for 2002-2007. It is now over 15 years since the leasing activity was completed. This is the comparison of the MMS anticipated production estimates and the actual production that occurred so far.

For $30 per barrel of Oil in Billions of Barrels

Planning Area	PFP	Actual So Far
Western GOM	1.31	0.182
Central GOM	3.27	0.399
Eastern GOM	0.17	0.009
Beaufort Sea	1.71	0.0
Chukchi Sea	2.42	0.0
Cook Inlet	0.34	0.0
Total	9.22	0.590

For $3.52 per MCF natural gas in TCF

Planning Area	PFP	Actual So Far
Western GOM	7.2	1.002
Central GOM	16.5	1.803
Eastern GOM	0.68	0.005
Cook Inlet	0.58	0.0
Total	24.96	2.810

The 2002-2007 delivered so far about 6.4% of the anticipated production of Oil of the entire program. For Central GOM Oil about 12% has been delivered. For the Western GOM Oil 14% has been delivered. If MMS had made anticipated production estimates of zero it would have been more accurate. This makes the case that in the past MMS vastly over estimated anticipated production.

Reserves Report Data

The following two perspectives is based on information in the reserves reports. This is the timeline for the reserves reporting. First the lease is issued. Next a discovery is made. When sufficient detailed is obtained an estimate of the original reserves are made by the GOM Region staff. It should be noted this is an independent and consistent assessment. The information is then incorporated into the annual report and published. An example, of the timeline is field KC872 (Lease Number G25823). The lease was issued on 12/1/2003. The discovery was made in 2008. The 2018 reserves reports the initial original reserves for KC872. That was the estimate as of 12/31/2018. Fifteen years after the lease issue date. Then it takes over two years for the report to be published.

Discovering New Fields

The anticipated production estimates imply that many new fields will be discovered. I did not find an explicit estimate of the number of new fields. There is a projection in the *Economic Analysis Methodology for the 2023-2028 National OCS Oil and Gas Leasing Program* Table 20 of a minimum of 26 Platforms/Structures and 17 Subsea structures. That implies a lower bound of about 40 new fields will emerge from 5 years of leasing.

Estimated Oil and Gas Reserves Gulf of Mexico OCS Region December 31, 2019, Table 6 shows how many fields are added each year in the Gulf of Mexico. This is the last 20 years of data (2000-2019).

New Fields Added in GOM by Year

Year	New Fields Added	Year	New Fields Added
2000	47	2010	4
2001	36	2011	10
2002	26	2012	5
2003	29	2013	3
2004	31	2014	6
2005	24	2015	6
2006	33	2016	3
2007	22	2017	4
2008	19	2018	0
2009	8	2019	6

This data is plotted in a bar chart to give a visual of the data.

In the five year time period of 2000-2004 169 new fields were added. Between 2015-2019 just 19 new fields were added. That is a drop of about 89%! This is a sharp decline. The likelihood of finding many more new fields a decade or more in the future is small.

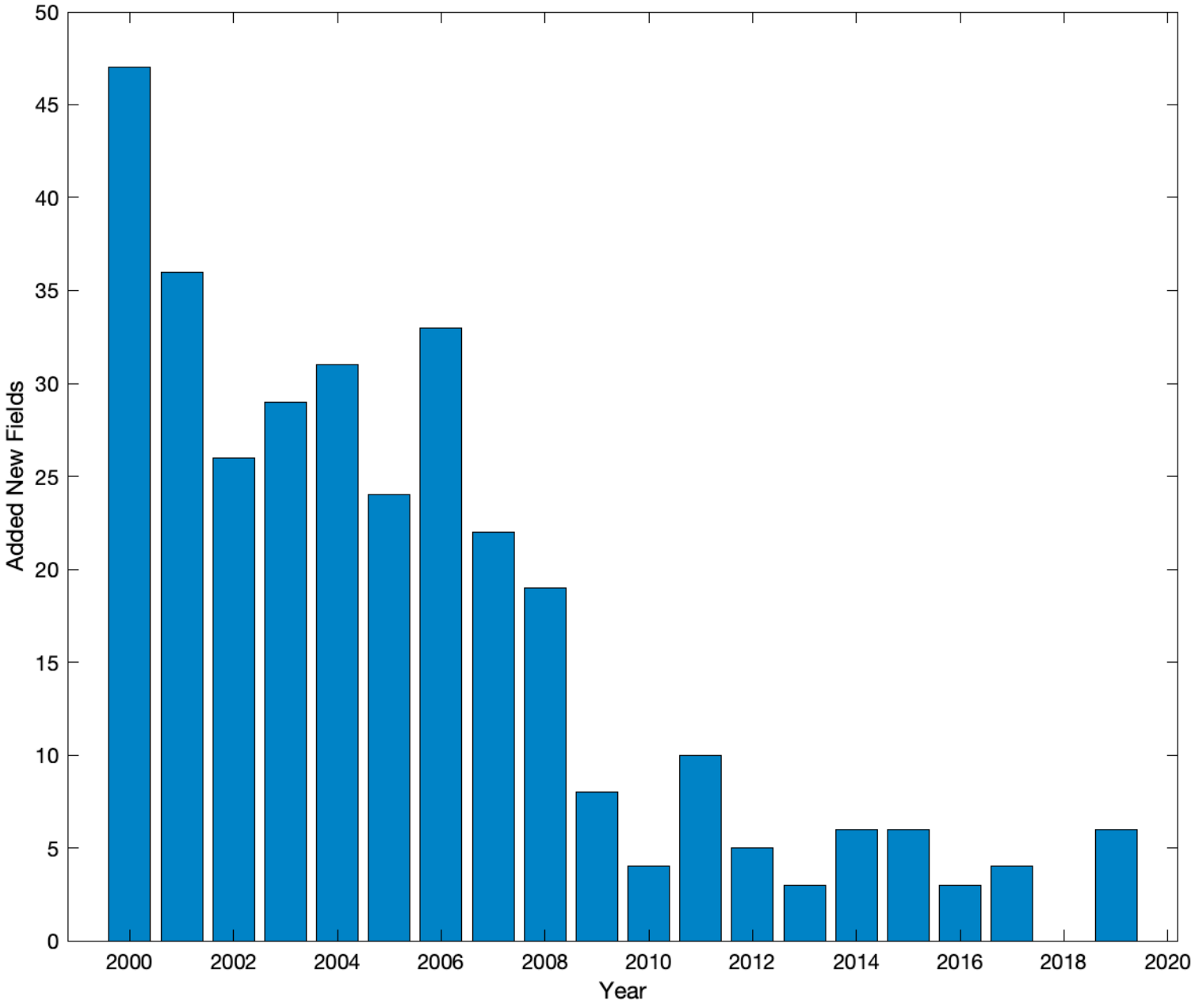
This makes the case that the rate of finding new fields in the Gulf of Mexico has collapsed.

Additions to Reserves from New Fields

Proposed Program, Table 5-2 displays Anticipated Production for GOM Program Area 1.

Activity Level	Low	Mid	High
Oil (Billions of Barrels)	0.56	3.2	7.62
Gas (TCF)	0.90	4.16	10.02

The following table displays the additions to reserves from new fields. It used Table 5 from the annual reserves report from 2019 to 2001. The Table 5 of reserves report for 2019 for Oil shows that 1.11 Billion Barrels was added from new fields. For 2018 0.0 Billions was added from new fields. For 2017 0.20 Billion was added for new fields. That is the process for the construction of the “Added Oil” column. The column “Reserve Cumulative Oil” is created by adding together the new field “Added Oil” from the current year to 2019. As an example the value for 2017 is the sum of 1.11 + 0.00 + 0.20 = 1.31. The same procedure was used for the Gas columns.


Added New Fields
Year
0
5
10
15
20
25
30
35
40
45
50
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020

Now compare those projections to the actual addition to reserves from new fields for the last 19 years from the annual reserves reports Table 5.

New Fields Initial Additions to Oil and Gas Reserves
In Billions of Barrels

Year	Added Oil	Reverse Cumulative Oil	Added Gas	Reverse Cumulative Gas
2019	1.11	1.11	0.5	0.5
2018	0.00	1.11	0.0	0.5
2017	0.20	1.31	0.2	0.7
2016	0.03	1.34	0.0	0.7
2015	0.26	1.60	0.2	0.9
2014	0.15	1.75	0.2	1.1
2013	0.01	1.76	0.0	1.1
2012	0.07	1.83	0.0	1.1
2011	0.46	2.29	0.8	1.9
2010	0.01	2.30	0.1	2.0
2009	0.01	2.31	0.2	2.2
2008	0.18	2.49	0.3	2.5
2007	0.01	2.50	0.5	3.0
2006	0.29	2.79	0.7	3.7
2005	0.06	2.85	0.2	3.9
2004	0.86	3.71	2.0	5.9
2003	0.01	3.72	0.4	6.3
2002	1.15	4.87	1.2	7.5
2001	1.38	6.25	1.4	8.9

The Anticipated Production at the Mid Activity(3.2) Level for Oil would exceed the reserved added from new fields from 2005 to 2019! This shows the Anticipated Production at the Mid Level Activity is projected to exceed the actual addition to reserves over the last 14 years of reported data. For the High Level(7.2) the Anticipated Production is above the actual new field additions for 2001 to 2019! The 7.2 Billion in Oil for the High Activity is about 27% of the current estimate of original oil reserves in the GOM. The Low Activity(0.56) forecast is consistent with recent experience. The open question is can the new field discovery rate declined be stopped for a period of 15 years until the 2023-2028 program fields will start appearing in the Reserves Reports.

Summary of Findings

- Looking back the anticipated production from the 2002-2007 5 Year Program is about 8 times higher than the actual results.

- The rate of finding new fields over 15 years has dropped to one 8th of the prior rate.

- The Anticipated Production for Mid level activity is equivalent to the last 14 years of additional Reserves from new fields.

Analysis

The Proposal has three levels of activities. A Mid Level assuming the $100 price level. High and Low Levels at $60 above and below the current price of oil.

The Mid Level anticipated production is equivalent to the actual increase in original oil reserves from new fields in the last 14 years of reporting. Further the new field discovery rate has collapsed. This forecast is disconnected from the reality in the GOM OCS. It is a repeat of 2002-2007 PFP over stating anticipated production. The rest of the net benefit analysis in this proposed program is built upon this flawed projection. The projected associated net benefits are also flawed.

For the High Level anticipated production is equivalent to about 27% of the current estimate of original oil reserves in the GOM, in spite of the fact that of new field discovery rate has collapsed. This projection is not credible.

For the Low Level of Activity forecast the projections are consistent with recent experience. However given the demonstrated collapse in rate of discovering new fields, the ability of the private sector to maintain the status quo is dubious for future years. The net benefit analysis in this proposed program for the Low Level Activity is near zero.

Employing an anticipated production estimate that is consistent with the GOM OCS experience will yield a very small net benefit.

Data Used Appendix

This paper uses extracted public data available on the BOEM website. This appendix provides those data extracts or a pointer to one very large data set employed. This will assist other investigators to slice and dice in different ways.

Look Back Analysis

The 2002-2007 PFP statement of anticipated production is the first page.

The Actual So Far is based on the OGOR-A data files. OGOR-A is the monthly reporting of production by well. The OGOR-A data was imported into a Microsoft Access database. Consolidated into a single table. Those records associated with Sales in 2002-2007 program were selected. Then the oil and gas production summed by Planning Area. OGOR-A data files are located at: https://www.data.boem.gov/Main/OGOR-A.asp.

Discovering New Fields

Is based on Table 6 of 2019 Reserves Report. It is part of this appendix.

Additions to Reserves from New Fields

Takes information from Table 5 from the Reserve Reports from 2019 to 2001. All those Tables 5 are in this appendix.

Economic Analysis

Economic Assumptions. The proposed final program is assumed to have a lifespan (leasing and subsequent exploration, development, and production) of approximately 40 years starting in July 2002. Given the uncertainty of future price levels, or the "price paths," for oil and gas throughout the 2002 to 2042 period, the MMS developed a range of possible prices bounded by a low price and a high price scenario. The low oil price is set at $18 per barrel (bbl). This price is consistent with typical worldwide levels over the last 10 years or so. The high oil price of $30 per bbl is consistent with the oil price highs that have been reached intermittently during the past 2 years. The MMS set the natural gas wellhead price at 66 percent of the oil price on a Btu-equivalent basis. The low natural gas wellhead price is $2.11 per Mcf and the high price is $3.52 per Mcf. In both cases, inflation-adjusted—or "real"—prices are assumed to remain constant throughout the productive life of all leases resulting from the new 5-year program. A real discount rate of 7 percent was chosen for the proposed final program analysis.

Table 6. Anticipated Production for Alternative 1—The Proposed Action

Program Area	Oil (BBO)	Gas (Tcf)
Western Gulf of Mexico	0.68 1.31	4.05 7.20
Central Gulf of Mexico	1.38 3.27	7.95 16.50
Eastern Gulf of Mexico	0.10 0.17	0.41 0.68
Beaufort Sea	1.02 1.71	Uneconomic
Chukchi Sea	0.96 2.42	Uneconomic
Cook Inlet	0.28 0.34	0.38 0.58
Hope Basin*	0.01 0.02	0.29 0.71
Norton Basin*	0.01 0.01	0.26 0.40

Base case estimates ($18 per bbl and $2.11 per Mcf) are shown first, with high case estimates ($30 per bbl and $3.52 per Mcf) underneath. Oil estimates are expressed in billions of barrels (BBO); natural gas estimates are expressed in trillions of cubic feet (Tcf).

*Estimates for these areas are based on the results of a study that shows what would be available to a local market (processing plant) at given prices.

Table 6. Oil and gas reserves and cumulative production at end of year, 1975-2019.

"Oil" includes crude oil and condensate; "gas" includes associated and nonassociated gas. Reserves estimated as of December 31 each year.

Year	Number of fields included	Original Reserves			Historical Cumulative Production			Reserves		
		Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
1975	255	6.61	59.9	17.27	3.82	27.2	8.66	2.79	32.7	8.61
1976	306	6.86	65.5	18.51	4.12	30.8	9.60	2.74	34.7	8.91
1977	334	7.18	69.2	19.49	4.47	35.0	10.70	2.71	34.2	8.80
1978	385	7.52	76.2	21.08	4.76	39.0	11.70	2.76	37.2	9.38
1979 (1)	417	7.71	82.2	22.34	4.83	44.2	12.69	2.88	38.0	9.64
1980	435	8.04	88.9	23.86	4.99	48.7	13.66	3.05	40.2	10.20
1981	461	8.17	93.4	24.79	5.27	53.6	14.81	2.90	39.8	9.98
1982	484	8.56	98.1	26.02	5.58	58.3	15.95	2.98	39.8	10.06
1983	521	9.31	106.2	28.21	5.90	62.5	17.02	3.41	43.7	11.19
1984	551	9.91	111.6	29.77	6.24	67.1	18.18	3.67	44.5	11.59
1985	575	10.63	116.7	31.40	6.58	71.1	19.23	4.05	45.6	12.16
1986	645	10.81	121.0	32.34	6.93	75.2	20.31	3.88	45.8	12.03
1987	704	10.76	122.1	32.49	7.26	79.7	21.44	3.50	42.4	11.04
1988	678	10.95	126.7	33.49	7.56	84.3	22.56	3.39	42.4	10.93
1989	739	10.87	129.1	33.84	7.84	88.9	23.66	3.03	40.2	10.18
1990	782	10.64	129.9	33.75	8.11	93.8	24.80	2.53	36.1	8.95
1991	819	10.74	130.5	33.96	8.41	98.5	25.94	2.33	32.0	8.02
1992	835	11.08	132.7	34.69	8.71	103.2	27.07	2.37	29.5	7.62
1993	849	11.15	136.8	35.49	9.01	107.7	28.17	2.14	29.1	7.32
1994	876	11.86	141.9	37.11	9.34	112.6	29.38	2.52	29.3	7.73
1995	899	12.01	144.9	37.79	9.68	117.4	30.57	2.33	27.5	7.22
1996	920	12.79	151.9	39.82	10.05	122.5	31.85	2.74	29.4	7.97
1997	957	13.67	158.4	41.86	10.46	127.6	33.17	3.21	30.8	8.69
1998	984	14.27	162.7	43.22	10.91	132.7	34.52	3.36	30.0	8.70
1999	1,003	14.38	161.3	43.08	11.40	137.7	35.90	2.98	23.6	7.18
2000	1,050	14.93	167.3	44.70	11.93	142.7	37.32	3.00	24.6	7.38
2001	1,086	16.51	172.0	47.11	12.48	147.7	38.77	4.03	24.3	8.35
2002	1,112	18.75	176.8	50.21	13.05	152.3	40.15	5.71	24.6	10.09
2003	1,141	18.48	178.2	50.19	13.61	156.7	41.49	4.87	21.5	8.70
2004	1,172	18.96	178.4	50.70	14.14	160.7	42.73	4.82	17.7	7.97
2005	1,196	19.80	181.8	52.15	14.61	163.9	43.77	5.19	17.9	8.38
2006	1,229	20.30	183.6	52.97	15.08	166.7	44.74	5.22	16.9	8.23
2007	1,251	20.43	184.6	53.28	15.55	169.5	45.71	4.88	15.1	7.57
2008	1,270	21.24	188.4	54.76	15.96	171.8	46.53	5.28	16.6	8.23
2009 (2)	1,278	21.20	190.2	55.03	16.53	176.8	47.99	4.67	13.3	7.04
2010	1,282	21.50	191.1	55.50	17.11	179.3	49.01	4.39	11.8	6.49
2011 (3)	1,292	21.91	192.4	56.15	17.59	181.1	49.81	4.32	11.3	6.34
2012	1,297	22.11	193.0	56.46	18.06	182.6	50.56	4.05	10.4	5.90
2013	1,300	22.19	193.0	56.53	18.52	184.0	51.25	3.67	9.0	5.28
2014	1,306	22.37	193.4	56.79	19.03	185.2	51.99	3.34	8.2	4.80
2015	1,312	23.06	193.8	57.56	19.58	186.5	52.78	3.48	7.3	4.78
2016	1,315	23.73	194.6	58.37	20.16	187.8	53.58	3.57	6.8	4.79
2017	1,319	24.65	195.2	59.39	20.78	188.9	54.39	3.87	6.3	5.00
2018	1,319	24.86	195.5	59.66	21.42	189.8	55.21	3.44	5.7	4.45
2019	1,325	26.77	197.0	61.83	22.12	190.9	56.09	4.65	6.1	5.74

(1) Gas plant liquids dropped from system
(2) Conversion of historical gas production to 14.73 pressure base.
(3) Includes Reserves Justified for Development

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2018*	**24.86**	**195.5**	**59.66**
Fields Added in 2019	1.11	0.5	1.20
Revisions	0.80	1.0	0.97
Estimate, as of 12/31/2019 (this report)	**26.77**	**197.0**	**61.83**
Cumulative production:			
Previous estimate, as of 12/31/2018*	**21.42**	**189.8**	**55.21**
Revisions	0.01	0.1	0.00
Production during 2019	0.69	1.0	0.88
Estimate, as of 12/31/2019 (this report)	**22.12**	**190.9**	**56.09**
Reserves:			
Previous estimate, as of 12/31/2018*	**3.44**	**5.7**	**4.45**
Fields Added in 2019	1.11	0.5	1.20
Revisions	0.79	0.9	0.97
Production during 2019	-0.69	-1.0	-0.88
Estimate, as of 12/31/2019 (this report)	**4.65**	**6.1**	**5.74**

*Burgess et.al., 2018

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2017*	**24.65**	**195.2**	**59.39**
Fields Added in 2018	0.00	0.0	0.00
Revisions	0.00	0.0	0.00
Estimate, as of 12/31/2018 (this report)	**24.86**	**195.5**	**59.66**
Cumulative production:			
Previous estimate, as of 12/31/2017*	**20.78**	**188.9**	**54.39**
Revisions	0.00	-0.1	0.00
Production during 2018	0.64	1.0	0.82
Estimate, as of 12/31/2018 (this report)	**21.42**	**189.8**	**55.21**
Reserves:			
Previous estimate, as of 12/31/2017*	**3.87**	**6.3**	**5.00**
Fields Added in 2018	0.00	0.0	0.00
Revisions	0.21	0.4	0.27
Production during 2018	-0.64	-1.0	-0.82
Estimate, as of 12/31/2018 (this report)	**3.44**	**5.7**	**4.45**

*Burgess et.al., 2018

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2016*	**23.73**	**194.6**	**58.37**
Fields Added in 2017	0.20	0.2	0.23
Revisions	0.72	0.4	0.79
Estimate, as of 12/31/2017 (this report)	**24.65**	**195.2**	**59.39**
Cumulative production:			
Previous estimate, as of 12/31/2016*	**20.16**	**187.8**	**53.58**
Revisions	0.01	0.0	0.01
Production during 2017	0.61	1.1	0.80
Estimate, as of 12/31/2017 (this report)	**20.78**	**188.9**	**54.39**
Reserves:			
Previous estimate, as of 12/31/2016*	**3.57**	**6.8**	**4.79**
Fields Added in 2017	0.20	0.2	0.23
Revisions	0.71	0.4	0.78
Production during 2017	-0.61	-1.1	-0.80
Estimate, as of 12/31/2017 (this report)	**3.87**	**6.3**	**5.00**

*Kazanis et.al., 2018

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2015*	**23.06**	**193.8**	**57.56**
Fields Added in 2016	0.03	0.0	0.04
Revisions	0.64	0.8	0.77
Estimate, as of 12/31/2016 (this report)	**23.73**	**194.6**	**58.37**
Cumulative production:			
Previous estimate, as of 12/31/2015*	**19.58**	**186.5**	**52.78**
Revisions	0.00	0.1	0.01
Production during 2016	0.58	1.2	0.79
Estimate, as of 12/31/2016 (this report)	**20.16**	**187.8**	**53.58**
Reserves:			
Previous estimate, as of 12/31/2015*	**3.48**	**7.3**	**4.78**
Fields Added in 2016	0.03	0.0	0.04
Revisions	0.64	0.7	0.76
Production during 2016	-0.58	-1.2	-0.79
Estimate, as of 12/31/2016 (this report)	**3.57**	**6.8**	**4.79**

*Kazanis et.al., 2016

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2014*	**22.37**	**193.4**	**56.79**
Fields Added in 2015	0.26	0.2	0.30
Revisions	0.43	0.2	0.47
Estimate, as of 12/31/2015 (this report)	**23.06**	**193.8**	**57.56**
Cumulative production:			
Previous estimate, as of 12/31/2014*	**19.03**	**185.2**	**51.99**
Revisions	0.00	0.0	0.01
Production during 2015	0.55	1.3	0.78
Estimate, as of 12/31/2015 (this report)	**19.58**	**186.5**	**52.78**
Reserves:			
Previous estimate, as of 12/31/2014*	**3.34**	**8.2**	**4.80**
Fields Added in 2015	0.26	0.2	0.30
Revisions	0.43	0.2	0.46
Production during 2015	-0.55	-1.3	-0.78
Estimate, as of 12/31/2015 (this report)	**3.48**	**7.3**	**4.78**

*Kazanis et.al., 2015

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2013*	**22.19**	**193.0**	**56.53**
Fields Added in 2014	0.15	0.2	0.18
Revisions	0.03	0.2	0.08
Estimate, as of 12/31/2014 (this report)	**22.37**	**193.4**	**56.79**
Cumulative production:			
Previous estimate, as of 12/31/2013*	**18.52**	**184.0**	**51.25**
Revisions	0.00	-0.1	0.00
Production during 2014	0.51	1.3	0.74
Estimate, as of 12/31/2014 (this report)	**19.03**	**185.2**	**51.99**
Reserves:			
Previous estimate, as of 12/31/2013*	**3.67**	**9.0**	**5.28**
Fields Added in 2014	0.15	0.2	0.18
Revisions	0.03	0.3	0.08
Production during 2014	-0.51	-1.3	-0.74
Estimate, as of 12/31/2014 (this report)	**3.34**	**8.2**	**4.80**

*Kazanis et.al., 2015

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimate, as of 12/31/2012*	**22.11**	**193.0**	**56.46**
Fields Added in 2013	0.01	0.0	0.01
Revisions	0.07	0.0	0.06
Estimate, as of 12/31/2013 (this report)	**22.19**	**193.0**	**56.53**
Cumulative production:			
Previous estimate, as of 12/31/2012*	**18.06**	**182.6**	**50.56**
Revisions	0.00	0.1	-0.01
Production during 2013	0.46	1.3	0.70
Estimate, as of 12/31/2013 (this report)	**18.52**	**184.0**	**51.25**
Reserves:			
Previous estimate, as of 12/31/2012*	**4.05**	**10.4**	**5.90**
Fields Added in 2013	0.01	0.0	0.01
Revisions	0.07	-0.1	0.07
Production during 2013	-0.46	-1.3	-0.70
Estimate, as of 12/31/2013 (this report)	**3.67**	**9.0**	**5.28**

*Kazanis et.al., 2015

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimates, as of 12/31/2011*	**21.91**	**192.4**	**56.15**
Discoveries	0.07	0.0	0.06
Revisions	0.08	0.3	0.13
Estimate, as of 12/31/2012 (this report)	**22.11**	**193.0**	**56.46**
Cumulative production:			
Previous estimates, as of 12/31/2011*	**17.59**	**181.1**	**49.81**
Revisions	0.00	0.0	0.01
Production during 2012	0.47	1.5	0.74
Estimate, as of 12/31/2012 (this report)	**18.06**	**182.6**	**50.56**
Reserves:			
Previous estimates, as of 12/31/2011*	**4.32**	**11.3**	**6.34**
Discoveries	0.12	0.3	0.18
Revisions	0.08	0.3	0.12
Production during 2012	-0.47	-1.5	-0.74
Estimate, as of 12/31/2012 (this report)	**4.05**	**10.4**	**5.90**

*Kazanis et.al., 2014

Table 5. Summary and comparison of oil and gas reserves as of December 31,

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Reserves:			
Previous estimates, as of 12/31/2010*	**21.50**	**191.1**	**55.50**
Discoveries	0.46	0.8	0.59
Revisions	-0.05	0.5	0.06
Estimate, as of 12/31/2011 (this report)	**21.91**	**192.4**	**56.15**
Cumulative production:			
Previous estimates, as of 12/31/2010*	**17.11**	**179.3**	**49.01**
Revisions	0.00	0.0	-0.01
Production during 2011	0.48	1.8	0.81
Estimate, as of 12/31/2011 (this report)	**17.59**	**181.1**	**49.81**
Reserves:			
Previous estimates, as of 12/31/2010*	**4.39**	**11.8**	**6.49**
Discoveries	0.46	0.8	0.59
Revisions	-0.05	0.5	0.07
Production during 2011	-0.48	-1.8	-0.81
Estimate, as of 12/31/2011 (this report)	**4.32**	**11.3**	**6.34**

*Kazanis et.al., 2013

Table 5. Summary and comparison of proved oil and gas reserves as of

	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Original Proved plus Probable reserves:			
Previous estimates, as of 12/31/2009*	**21.20**	**190.2**	**55.03**
Discoveries	0.01	0.1	0.02
Revisions	0.29	0.8	0.45
Estimate, as of 12/31/2010 (this report)	**21.50**	**191.1**	**55.50**
Cumulative production:			
Previous estimates, as of 12/31/2009*	**16.53**	**176.8**	**47.99**
Revisions	0.02	0.3	0.06
Production during 2010	0.56	2.2	0.96
Estimate, as of 12/31/2010 (this report)	**17.11**	**179.3**	**49.01**
Proved plus Probable reserves:			
Previous estimates, as of 12/31/2009*	**4.67**	**13.3**	**7.04**
Discoveries	0.01	0.1	0.02
Revisions	0.27	0.6	0.39
Production during 2010	-0.56	-2.2	-0.96
Estimate, as of 12/31/2010 (this report)	**4.39**	**11.8**	**6.49**

*Maclay et.al., 2013

Table 5. --Summary and comparison of GOM Proved oil and gas reserves as of

	Oil (billion bbl)	Gas trillion cu ft	BOE (billion bbl)
Original Proved reserves:			
Previous estimates, as of 12/31/2008	**21.24**	**188.4**	**54.76**
Discoveries	0.01	0.2	0.04
Revisions	-0.05	1.6*	0.23
Estimate, as of 12/31/2009 (this report)	**21.20**	**190.2**	**55.03**
Cumulative production:			
Previous estimates, as of 12/31/2008	**15.96**	**171.8**	**46.53**
Revisions	0.00	2.6*	0.00
Production during 2009	0.57	2.4	1.46
Estimate, as of 12/31/2009 (this report)	**16.53**	**176.8**	**47.99**
Proved reserves:			
Previous estimates, as of 12/31/2008	**5.28**	**16.6**	**8.23**
Discoveries	0.01	0.2	0.04
Revisions	-0.05	-1.0*	0.23
Production during 2009	-0.57	-2.4	-1.46
Estimate, as of 12/31/2009 (this report)**	**4.67**	**13.3**	**7.04**

*Value includes one-time conversion of pressure base to 14.73.

**Summation of individual values may differ from total values due to rounding.

Table 9. --Summary and comparison of GOM Proved oil and gas reserves as of

	Oil (billion bbl)	Gas trillion cu ft	BOE (billion bbl)
Original Proved reserves:			
Previous estimates, as of 12/31/2007*	**20.43**	**184.6**	**53.28**
Discoveries	0.18	0.3	0.23
Revisions	0.63	3.5	1.25
Estimate, as of 12/31/2008 (this report)	**21.24**	**188.4**	**54.76**
Cumulative production:			
Previous estimates, as of 12/31/2007*	**15.55**	**169.5**	**45.71**
Discoveries	0.00	0.0	0.00
Revisions	0.41	2.3	0.82
Estimate, as of 12/31/2008 (this report)	**15.96**	**171.8**	**46.53**
Proved reserves:			
Previous estimates, as of 12/31/2007*	**4.88**	**15.1**	**7.57**
Discoveries	0.18	0.3	0.23
Revisions	0.63	3.5	1.25
Production during 2008	-0.41	-2.3	-0.82
Estimate, as of 12/31/2008 (this report)	**5.28**	**16.6**	**8.23**

*Crawford et.al., 2011

Table 9. --Summary and comparison of proved oil and gas reserves as of

	Oil (billion bbl)	Gas trillion cu ft	BOE (billion bbl)
Proved reserves:			
Previous estimates, as of 12/31/2006*	**20.30**	**183.6**	**52.97**
Discoveries	0.01	0.5	0.10
Revisions	0.12	0.5	0.21
Estimate, as of 12/31/2007 (this report)	**20.43**	**184.6**	**53.28**
Cumulative production:			
Previous estimates, as of 12/31/2006*	**15.08**	**166.7**	**44.74**
Discoveries	0.00	0.0	0.00
Revisions	0.47	2.8	0.97
Estimate, as of 12/31/2007 (this report)	**15.55**	**169.5**	**45.71**
Remaining proved reserves:			
Previous estimates, as of 12/31/2006*	**5.22**	**16.9**	**8.23**
Discoveries	0.01	0.5	0.10
Revisions	0.12	0.5	0.21
Production during 2007	-0.47	-2.8	-0.97
Estimate, as of 12/31/2007 (this report)	**4.88**	**15.1**	**7.57**

*Crawford et.al., 2009

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2005, and December 31, 2006.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/2005*	**19.80**		**181.8**	
Discoveries	0.29		0.7	
Revisions	0.21		1.1	
Net Change	**0.50**		**1.8**	
Estimate, as of 12/31/2006 (this report)		**20.30**		**183.6**
Cumulative production:				
Previous estimates, as of 12/31/2005*	**14.61**		**163.9**	
Discoveries	0.00		0.0	
Revisions	0.47		2.8	
Net Change	**0.47**		**2.8**	
Estimate, as of 12/31/2006 (this report)		**15.08**		**166.7**
Remaining proved reserves:				
Previous estimates, as of 12/31/2005*	**5.19**		**17.9**	
Discoveries	0.29		0.7	
Revisions	0.21		1.1	
Production during 2006	-0.47		-2.8	
Net Change	**0.03**		**-1.0**	
Estimate, as of 12/31/2006 (this report)		**5.22**		**16.9**

*Crawford and others, 2009

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2004, and December 31, 2005.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/2004*	**18.96**		**178.4**	
Discoveries	0.06		0.2	
Revisions	0.78		3.2	
Net Change	**0.84**		**3.4**	
Estimate, as of 12/31/2005 (this report)		**19.80**		**181.8**
Cumulative production:				
Previous estimates, as of 12/31/2004*	**14.14**		**160.7**	
Discoveries	0.00		0.0	
Revisions	0.47		3.2	
Net Change	**0.47**		**3.2**	
Estimate, as of 12/31/2005 (this report)		**14.61**		**163.9**
Remaining proved reserves:				
Previous estimates, as of 12/31/2004*	**4.82**		**17.7**	
Discoveries	0.06		0.2	
Revisions	0.78		3.2	
Production during 2005	-0.47		-3.2	
Net Change	**0.37**		**0.2**	
Estimate, as of 12/31/2005 (this report)		**5.19**		**17.9**

*Crawford and others, 2007

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2003, and December 31, 2004.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/2003*	**18.48**		**178.2**	
Discoveries	0.86		2.0	
Revisions	-0.38		-1.8	
Net Change	**0.48**		**0.2**	
Estimate, as of 12/31/2004 (this report)		**18.96**		**178.4**
Cumulative production:				
Previous estimates, as of 12/31/2003*	**13.61**		**156.7**	
Discoveries	0.00		0.0	
Revisions	0.53		4.0	
Net Change	**0.53**		**4.0**	
Estimate, as of 12/31/2004 (this report)		**14.14**		**160.7**
Remaining proved reserves:				
Previous estimates, as of 12/31/2003*	**4.87**		**21.5**	
Discoveries	0.86		2.0	
Revisions	-0.38		-1.8	
Production during 2004	-0.53		-4.0	
Net Change	**-0.05**		**-3.8**	
Estimate, as of 12/31/2004 (this report)		**4.82**		**17.7**

*Crawford and others, 2006

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2002, and December 31, 2003.

	Oil (billion bbl)	Gas (trillion cu ft)
Proved reserves:		
Previous estimates, as of 12/31/2002*	**18.75**	**176.8**
Discoveries	0.01	0.4
Revisions	-0.28	1.0
Net Change	**-0.27**	**1.4**
Estimate, as of 12/31/2003 (this report)	**18.48**	**178.2**
Cumulative production:		
Previous estimates, as of 12/31/2002*	**13.04**	**152.2**
Discoveries	0.00	0.0
Revisions	0.57	4.5
Net Change	**0.57**	**4.5**
Estimate, as of 12/31/2003 (this report)	**13.61**	**156.7**
Remaining proved reserves:		
Previous estimates, as of 12/31/2002*	**5.71**	**24.6**
Discoveries	0.01	0.4
Revisions	-0.28	1.0
Production during 2003	-0.57	-4.5
Net Change	**-0.84**	**-3.1**
Estimate, as of 12/31/2003 (this report)	**4.87**	**21.5**

*Crawford and others, 2005

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2001, and December 31, 2002.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/2001*	**16.51**		**172.0**	
Discoveries	1.15		1.2	
Revisions	1.09		3.6	
Net Change	**2.24**		**4.8**	
Estimate, as of 12/31/2002 (this report)		**18.75**		**176.8**
Cumulative production:				
Previous estimates, as of 12/31/2001*	**12.48**		**147.7**	
Discoveries	0.00		0.0	
Revisions	0.56		4.5	
Net Change	**0.56**		**4.5**	
Estimate, as of 12/31/2002 (this report)		**13.04**		**152.2**
Remaining proved reserves:				
Previous estimates, as of 12/31/2001*	**4.03**		**24.3**	
Discoveries	1.15		1.2	
Revisions	1.09		3.6	
Production during 2002	-0.56		-4.5	
Net Change	**1.68**		**0.3**	
Estimate, as of 12/31/2002 (this report)		**5.71**		**24.6**

*Crawford and others, 2004

Table 5. --Summary and comparison of proved oil and gas reserves as of December 31, 2000, and December 31, 2001.

	Oil (billion bbl)	Gas (trillion cu ft)
Proved reserves:		
Previous estimates, as of 12/31/2000*	**14.93**	**167.3**
Discoveries	1.38	1.38
Revisions	0.20	1.9
Net Change	**1.58**	**3.28**
Estimate, as of 12/31/2001 (this report)	**16.51**	**170.6**
Cumulative production:		
Previous estimates, as of 12/31/2000*	**11.93**	**142.7**
Discoveries	0.00	0.0
Revisions	0.55	5.0
Net Change	**0.55**	**5.0**
Estimate, as of 12/31/2001 (this report)	**12.48**	**147.7**
Remaining proved reserves:		
Previous estimates, as of 12/31/2000*	**3.00**	**24.6**
Discoveries	1.38	2.8
Revisions	0.20	1.9
Production during 2001	-0.55	-5.0
Net Change	**1.03**	**-0.3**
Estimate, as of 12/31/2001 (this report)	**4.03**	**24.3**

*Crawford and others, 2003