Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016a

Using a play based assessment methodology, the Bureau of Ocean Energy Management estimates a mean of 90.55 billion barrels of undiscovered technically recoverable oil and a mean of 327.58 trillion cubic feet of undiscovered technically recoverable natural gas in the Federal Outer Continental Shelf of the United States.

This publication includes updates to two geologic plays in the Beaufort Sea of the Alaska OCS effective December, 2017.

BOEM
Bureau of Ocean Energy Management

Figure 1. Federal Outer Continental Shelf areas of the United States.

Introduction

This report summarizes the results of the Bureau of Ocean Energy Management (BOEM) 2016 assessment of the undiscovered oil and gas resources for the U.S. Outer Continental Shelf (OCS). The OCS comprises the portion of the submerged seabed whose mineral estate is subject to Federal jurisdiction (Figure 1). The 2016 assessment represents a comprehensive appraisal that considers relevant data and information available as of January 1, 2014, and builds upon previous assessment efforts on the OCS.

This assessment provides estimates of undiscovered, technically and economically recoverable oil and natural gas resources located outside of known oil and gas fields on the OCS. It considers recent geophysical, geological, technological, and economic information and utilizes a probabilistic play-based approach to estimate the undiscovered technically recoverable resources of oil and gas for individual geologic plays. This methodology is suitable for both conceptual plays where there is little specific information available and for developed plays where considerable information from discovered oil and gas fields is available. Individual geologic play results are aggregated to larger areas including Basins, Planning Areas, and Regions. Estimates of the quantities of historical production, remaining reserves, contingent resources, and future reserves appreciation are presented as components of total endowment to provide a frame of reference. More detailed information about the geology, assessment methodology, and economics will be made available in separate play-specific regional assessment reports.

Commodities Assessed

Commodities assessed include crude oil, natural gas liquids (condensate), and natural gas that exist in conventional reservoirs and are producible with conventional recovery techniques. Crude oil and condensate are reported jointly as oil; associated and nonassociated gas are reported as gas. Oil volumes are reported as billions of stock tank barrels of oil (Bbo) and gas as trillion standard cubic feet of gas (Tcfg). Oil-equivalent gas is a volume of gas (associated and/or nonassociated) expressed in terms of its energy equivalence to oil (i.e., 5,620 cubic feet of gas per barrel of oil). The combined volume of oil and oil-equivalent gas resources is referred to as barrel of oil-equivalent (BOE) and is reported in billions of barrels (Bbo).

To ensure consistency in reporting recoverable resources across all OCS regions, this assessment does not include quantities of hydrocarbon resources that could be recovered from known and future fields by enhanced recovery techniques. It also does not consider methane hydrates, gas in geopressured brines, or oil and natural gas that may be present in insufficient quantities or quality (low permeability "tight" reservoirs) to be produced by conventional recovery techniques.

Estimates of undiscovered recoverable resources are presented in two categories; undiscovered technically recoverable resources (UTRR), and undiscovered economically recoverable resources (UERR). UTRR estimates are generated stochastically and are reported here at the mean value and at the 95th and 5th percentile values. This range of estimates corresponds to a 95 percent probability (a 19 in 20 chance) and a 5 percent probability (a 1 in 20 chance) of there being more than those amounts present, respectively. The 95 and 5 percent probabilities are considered reasonable minimum and maximum values, and the mean is the average or expected value. UERR results are presented as price-

supply curves which show the relationship of commodity price to economically recoverable resource. Price supply curves couple oil prices with gas prices to reflect fixed economic values of gas relative to oil. Due to fluctuations in the economic value of gas, the 2016 assessment analyzed four different British Thermal Unit (BTU)-based price pairings between oil and gas. These pairings represent gas prices that assume a 30 percent, 40 percent, 60 percent, and 100 percent economic value of gas relative to oil on a BTU basis.

Methodology

The 2016 assessment of undiscovered resources incorporates a play-based approach toward the analysis of hydrocarbon potential. The play-based approach provides a strong relationship between information derived from oil and gas exploration activities and the geologic model developed by the assessment team. An extensive effort was undertaken in developing play models, delineating the geographic limits of each play, and compiling data on geologic and reservoir engineering parameters. These parameters are used in determining the total quantities of recoverable resources in each play. The BOEM assessment model utilizes a probabilistic approach to account for the inherent uncertainties associated with an assessment of undiscovered resources. Results are reported as a range of values corresponding to different probabilities of occurrence.

Due to sparse data associated with many of the geologic plays in the Alaska, Atlantic, and portions of the Pacific OCS Regions, analog plays are developed with a subjective approach to cover the range of uncertainties associated with these plays. For mature areas with significant amounts of data, such as the Gulf of Mexico and southern California, geologic plays are analyzed by combining the subjective methodology utilizing historical trends with a discovery-based approach to account for the existing discovered pools. The economic portion of the assessment incorporates a range of oil and gas price points and utilizes a relationship between the cost of exploration and development and commodity prices.

Assessment Results

The 2016 assessment represents a multi-year effort that includes data and information available as of January 1, 2014, with an update in December, 2017 for a Beaufort Sea reassessment. Estimates of UTRR oil for the entire OCS range from 76.69 Bbo at the P_{95} percentile to 105.59 Bbo at the P_5 percentile, with a mean of 90.55 Bbo (Figure 2 and Table 1). Similarly, gas estimates range from 284.41 Tcfg to 375.87 Tcfg with a mean of 327.58 Tcfg. On a BOE basis approximately 50 percent of the potential resources are located within the Gulf of Mexico. The Alaska OCS ranks second with 34 percent. The Pacific is third among the regions in terms of oil potential and fourth with respect to gas. The Atlantic region ranks third when considering gas potential and fourth in terms of oil.

Estimates of UERR are presented as price-supply curves for the entire OCS in Figure 3, and Appendix A has price-supply

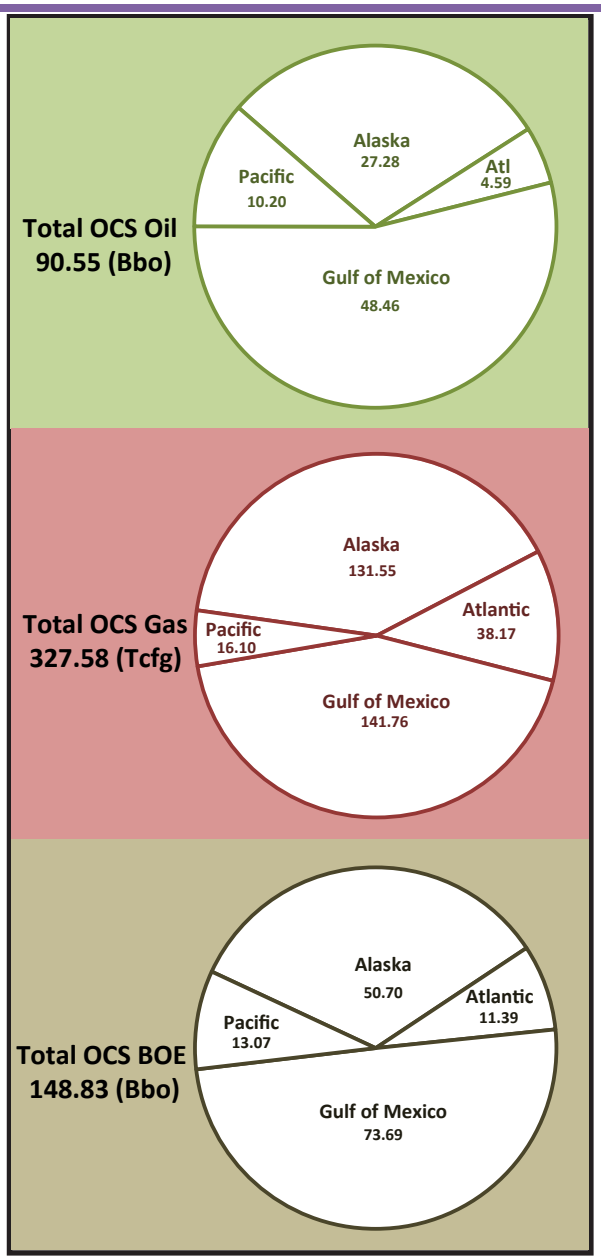

Figure 2. Mean Undiscovered Technically Recoverable Resources by type and region.

curves for individual regions. A price-supply curve shows the relationship of price to economically recoverable resource volumes (i.e., a horizontal line from the price axis to the curve yields the quantity of economically recoverable resources at the selected price). The price-supply charts contain two curves and two price scales, one for oil (green) and one for gas (red). The curves represent mean values at any specific price. The two vertical lines indicate the mean estimates of UTRR oil and gas resources for the specific area or region. At high prices, the economically recoverable resource volumes approach the technically recoverable volumes. Price-supply curves represent resources available given sufficient exploration and development efforts and do not imply an immediate response to price changes. The oil and gas price-supply curves are not independent of each other; that is, one specific oil price cannot be used to obtain an oil resource while a separate unrelated gas price is used to obtain a gas resource. The gas price is dependent on the oil price and must be used in conjunction with the oil price on the opposite

Region / Planning Area	Risked Undiscovered Technically Recoverable Oil and Gas Resources (UTRR)								
	Oil (Bbo)			Gas (Tcfg)			BOE (Bbo)		
	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%
Alaska OCS*	**19.09**	**27.28**	**37.43**	**96.76**	**131.55**	**167.98**	**36.30**	**50.70**	**67.32**
Chukchi Sea	9.30	15.38	23.08	48.88	76.77	111.44	17.99	29.04	42.91
Beaufort Sea	4.11	8.90	13.72	13.92	27.74	43.78	6.59	13.84	21.51
Hope Basin	0.00	0.15	0.45	0.00	3.77	10.40	0.00	0.82	2.30
Navarin Basin	0.00	0.13	0.42	0.00	1.22	3.67	0.00	0.35	1.07
North Aleutian Basin	0.12	0.75	1.82	1.47	8.62	17.37	0.38	2.29	4.91
St. George Basin	0.00	0.21	0.57	0.00	2.80	6.69	0.00	0.71	1.76
Norton Basin	0.00	0.06	0.17	0.00	3.06	9.65	0.00	0.60	1.89
Cook Inlet	0.25	1.01	2.01	0.50	1.20	1.97	0.34	1.23	2.36
Gulf of Alaska	0.13	0.63	1.45	0.71	4.04	9.23	0.25	1.34	3.09
Shumagin	0.00	0.01	0.05	0.00	0.49	2.04	0.00	0.10	0.42
Kodiak	0.00	0.05	0.20	0.00	1.84	7.62	0.00	0.38	1.55
*The Aleutian Arc, Aleutian Basin, Bowers Basin, and St. Matthew-Hall Planning Areas in the Alaska OCS Region were not evaluated in this study as their petroleum potential is negligible.									
Atlantic OCS	**1.15**	**4.59**	**9.19**	**12.80**	**38.17**	**68.71**	**3.43**	**11.39**	**21.41**
North Atlantic	0.06	1.77	5.11	1.08	11.76	32.74	0.25	3.86	10.94
Mid-Atlantic	0.10	2.41	5.54	2.13	24.63	50.03	0.48	6.79	14.44
South Atlantic	0.00	0.41	0.90	0.00	1.78	5.00	0.00	0.73	1.79
Gulf of Mexico OCS	**39.48**	**48.46**	**58.53**	**124.01**	**141.76**	**159.63**	**61.55**	**73.69**	**86.93**
Western Gulf of Mexico	8.20	11.57	15.56	32.09	38.99	45.65	13.91	18.50	23.68
Central Gulf of Mexico	24.67	33.25	42.74	77.72	91.27	105.65	38.50	49.49	61.53
Eastern Gulf of Mexico	2.35	3.63	5.28	7.15	11.49	16.20	3.62	5.68	8.16
Straits of Florida	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.02
Pacific OCS	**6.96**	**10.20**	**14.03**	**10.52**	**16.10**	**23.92**	**8.83**	**13.07**	**18.28**
Washington/Oregon	0.00	0.40	1.14	0.03	2.28	5.80	0.01	0.81	2.18
Northern California	1.07	2.08	3.55	2.14	3.58	5.35	1.45	2.71	4.50
Central California	1.22	2.40	3.87	1.16	2.49	4.19	1.42	2.84	4.61
Southern California	2.82	5.32	8.70	3.58	7.76	13.60	3.46	6.70	11.12
Total U.S. OCS	**76.69**	**90.55**	**105.59**	**284.41**	**327.58**	**375.87**	**127.29**	**148.83**	**172.47**

Table 1. Risked Undiscovered Technically Recoverable Resources of OCS Planning Areas. Resource values are in billion barrels of oil (Bbo) and trillion cubic of gas (Tcfg). 95% indicates a 95 percent chance of at least the amount listed; 5% indicates a 5 percent chance of at least the amount listed. Only mean values are additive. Some total mean values may not equal the sum of the component values due to independent rounding. Values for UTRR results are for both leased and unleased lands of the Federal OCS.

axis of the chart to calculate resources. This is because oil and gas frequently occur together and individual pool economics are calculated using the coupled pricing. A different gas price associated with the oil price would result in a different resource value than that shown on the curve. Due to fluctuations in the economic value of gas relative to oil, four different BTU-based price pairings for oil and gas were analyzed. Table 2 presents specific price pairs associated with a 30 percent economic value of gas relative to oil.

Estimates of the total endowment of hydrocarbons on the OCS are presented in Table 3. The total endowment comprises the sum of historic production, remaining reserves, future reserves appreciation, contingent resources, and UTRR. Mean estimates of the total endowment for the entire OCS are 128 Bbo and 577 Tcfg, or 231 BBOE.

After more than 60 years of OCS exploration and development, BOEM estimates that about 65 percent of the total endowment remains undiscovered and is represented by the UTRR; more than 23 percent of the total endowment has already been produced; and approximately 12 percent is attributed to remaining reserves, contingent resources, and reserves appreciation.

Comparison with Previous Assessments

A comparison of 1995, 2000, 2006, 2011, and 2016 UTRR assessment results is shown on Figure 4. At the mean level, the estimates of UTRR for the entire OCS represent an increase of 0.53 Bbo (about 1 percent) for oil when compared to the previous (2011) assessment and a decrease of 77.02 Tcfg for gas (about 19 percent). Comparisons to previous assessments for each OCS region can be found in Appendix B.

In the Gulf of Mexico, the UTRR mean estimate for oil remained statistically unchanged, increasing 0.1 percent to 48.46 Bbo, while estimates for gas decreased from 219.46 Tcfg to 141.76 Tcfg (35 percent). The decrease in UTRR gas is attributed to a refinement of field size distributions for geologic plays in shallow water that better represent our understanding of recent exploratory well results, recently discovered gas fields, and the range of prospect sizes that have received bids in recent Gulf of Mexico Lease Sales.

The Atlantic OCS Region mean estimates of UTRR were updated in 2014 to 4.72 Bbo and 37.51 Tcfg, due in large part to the availability of new information derived from global analog

Region / Planning Area	Risked Undiscovered Economically Recoverable Oil and Gas Resources (UERR)											
	$30/Bbl $1.60/Mcf		$40/Bbl $2.14/Mcf		$60/Bbl $3.20/Mcf		$100/Bbl $5.34/Mcf		$110/Bbl $5.87/Mcf		$160/Bbl $8.54/Mcf	
	Oil	Gas	Oil	Gas	Oil	Gas	Oil	Gas	Oil	Gas	Oil	Gas
Alaska OCS*	**0.68**	**0.26**	**2.12**	**1.16**	**8.38**	**9.36**	**17.29**	**33.59**	**18.57**	**38.59**	**22.00**	**60.43**
Chukchi Sea	0.00	0.00	0.07	0.06	2.87	4.25	9.25	22.58	10.20	26.36	12.61	40.63
**Beaufort Sea	0.07	0.03	1.02	0.66	4.01	4.15	6.08	8.09	6.33	8.80	7.09	12.64
Hope Basin	0.00	0.00	0.01	0.02	0.04	0.08	0.06	0.17	0.06	0.20	0.08	0.90
Navarin Basin	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.12	0.05	0.16	0.07	0.30
North Aleutian Basin	0.14	0.05	0.33	0.13	0.46	0.22	0.51	0.34	0.52	0.38	0.55	0.86
St. George Basin	0.00	0.00	0.02	0.02	0.07	0.07	0.10	0.15	0.11	0.17	0.13	0.66
Norton Basin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.40
Cook Inlet	0.62	0.25	0.81	0.33	0.94	0.40	0.98	0.77	0.99	0.84	1.00	1.03
Gulf of Alaska	0.00	0.00	0.00	0.01	0.07	0.20	0.31	1.62	0.36	1.93	0.47	2.73
Shumagin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Kodiak	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.05	0.02	0.54
*The Aleutian Arc, Aleutian Basin, Bowers Basin, and St. Matthew-Hall Planning Areas in the Alaska OCS Region were not evaluated in this study as their petroleum potential is negligible. **UERR for the 2017 Beaufort Sea update are not included in this table.												
Atlantic OCS	**3.21**	**3.64**	**3.47**	**5.06**	**3.76**	**8.41**	**4.00**	**13.00**	**4.03**	**13.81**	**4.15**	**17.22**
North Atlantic	1.40	1.82	1.48	2.45	1.58	3.69	1.64	5.05	1.65	5.28	1.68	6.24
Mid-Atlantic	1.74	1.68	1.89	2.41	2.06	4.38	2.18	7.42	2.19	7.97	2.25	10.29
South Atlantic	0.08	0.14	0.09	0.20	0.12	0.35	0.18	0.52	0.19	0.56	0.22	0.69
Gulf of Mexico OCS	**31.31**	**44.48**	**35.01**	**56.09**	**39.55**	**74.67**	**42.88**	**92.04**	**43.31**	**94.51**	**44.77**	**103.47**
Western Gulf of Mexico	7.28	12.03	8.21	15.88	9.36	21.84	10.20	27.23	10.31	27.98	10.68	30.53
Central Gulf of Mexico	21.69	27.82	24.22	35.02	27.31	46.74	29.56	57.83	29.85	59.41	30.84	65.21
Eastern Gulf of Mexico	2.34	4.62	2.58	5.18	2.88	6.08	3.10	6.97	3.13	7.12	3.24	7.72
Straits of Florida	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Pacific OCS	**4.00**	**5.30**	**5.10**	**6.61**	**6.45**	**8.29**	**7.30**	**9.43**	**7.43**	**9.62**	**7.89**	**10.35**
Washington/Oregon	0.09	0.32	0.14	0.46	0.20	0.65	0.23	0.79	0.24	0.81	0.26	0.93
Northern California	0.60	0.65	0.83	0.91	1.13	1.25	1.34	1.52	1.37	1.57	1.50	1.77
Central California	1.35	1.42	1.63	1.71	1.91	2.00	2.08	2.17	2.11	2.20	2.18	2.27
Southern California	1.96	2.91	2.50	3.54	3.21	4.39	3.65	4.94	3.72	5.03	3.95	5.37
Total U.S. OCS	**39.20**	**53.67**	**45.70**	**68.93**	**58.15**	**100.73**	**71.47**	**148.05**	**73.35**	**156.53**	**78.81**	**191.46**

Table 2. Risked Undiscovered Economically Recoverable Resources of OCS Planning Areas. Resource values are in billion barrels of oil (Bbo) and trillion cubic of gas (Tcfg). Some total mean values may not equal the sum of the component values due to independent rounding. Prices are in dollars per barrel($/Bbl) for oil, and dollars per thousand cubic feet ($/Mcf) for gas. Table 2 represents a gas price adjustment of 0.3. Values for UERR results are for both leased and unleased lands of the Federal OCS.

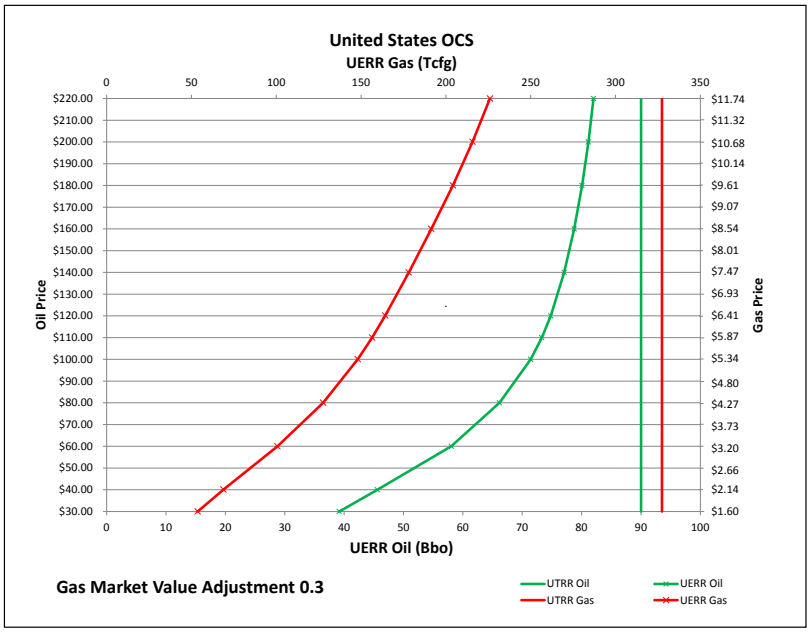

Figure 3. Price supply curve of the entire United States OCS.

Resource Category		Endowment for the U.S. OCS				
		Alaska	Atlantic	Gulf of Mexico	Pacific	Total OCS
Cumulative Production	Oil (Bbo)	0.03	-	18.52	1.31	19.86
	Gas (Tcf)	0.00	-	184.00	1.8	185.80
	BOE (Bbo)	0.03	-	51.25	1.63	52.91
Remaining Reserves	Oil (Bbo)	0.01	-	3.67	0.29	3.97
	Gas (Tcf)	0.00	-	9.00	0.58	9.58
	BOE (Bbo)	0.01	-	5.28	0.39	5.68
Contingent Resources	Oil (Bbo)		-	3.29	1.31	4.60
	Gas (Tcf)		-	11.3	0.93	12.23
	BOE (Bbo)		-	5.31	1.47	6.78
Reserves Appreciation	Oil (Bbo)	-	-	8.94	-	8.94
	Gas (Tcf)	-	-	41.31	-	41.31
	BOE (Bbo)	-	-	16.29	-	16.29
UTRR (Mean)	Oil (Bbo)	27.28	4.59	48.46	10.20	90.55
	Gas (Tcf)	131.55	38.17	141.76	16.10	327.58
	BOE (Bbo)	50.70	11.39	73.69	13.07	148.83
Total Endowment	Oil (Bbo)	27.32	4.59	82.88	13.11	127.89
	Gas (Tcf)	131.55	38.17	387.37	19.41	576.50
	BOE (Bbo)	50.74	11.39	151.82	16.56	230.51

Table 3. Distribution of total hydrocarbon endowment by type, region, and resource category. Some total mean values may not equal the sum of the component values due to independent rounding. Values for cumulative production, remaining reserves, and contingent resources are based on data available as of January 1, 2014, with Alaska numbers updated in December 2017 for the Beaufort Sea reassessment.

plays. For the 2016 assessment, only minor revisions have been incorporated resulting in a slight decrease to mean oil volume and slight increase to mean gas volume, now 4.59 Bbo and 38.17 Tcfg, respectively.

Mean estimates of UTRR for the Alaska OCS Region remain relatively unchanged in comparison to the previous assessment at 27.28 Bbo and 131.55 Tcfg. Prior to the data cutoff date of January 1, 2014, there were effectively no significant new geologic data gathered in the region and none of the leases acquired since the previous assessment had been tested. In December of 2017, an update to the UTRR for two of the geologic plays in the Beaufoort Sea OCS Planning Area were updated. Those UTRR values have been reflected in this fact sheet.

The Pacific OCS Region mean UTRR estimates of 10.20 Bbo and 16.10 Tcfg remain unchanged for both oil and natural gas when compared to the previous assessment. The only new activities occurring in the region since the last assessment were in the existing producing fields in the Southern California Planning Area.

The UERR volumes shown in Table 2 and the price-supply curves shown in Figure 3 and Appendix A are presented using a gas price adjustment factor 0.3 to account for the relative value of gas compared to a barrel of crude oil at the time of the assessment. It is important to note, UERR values for all OCS regions have decreased since last reported in 2011, where a 0.4 adjustment factor was used. In addition, the 2016 UERR reflect changes to a number of engineering, economic, and production assumptions. Specifically, UERR gas resources in Alaska have declined since 2011 due to the implementation of an increased tariff required by changes in the presumed delivery of gas via liquefied natural gas tanker systems. In the Atlantic OCS, UERR gas volumes are down slightly from 2011 due largely to an improved understanding of potential reservoir performance.

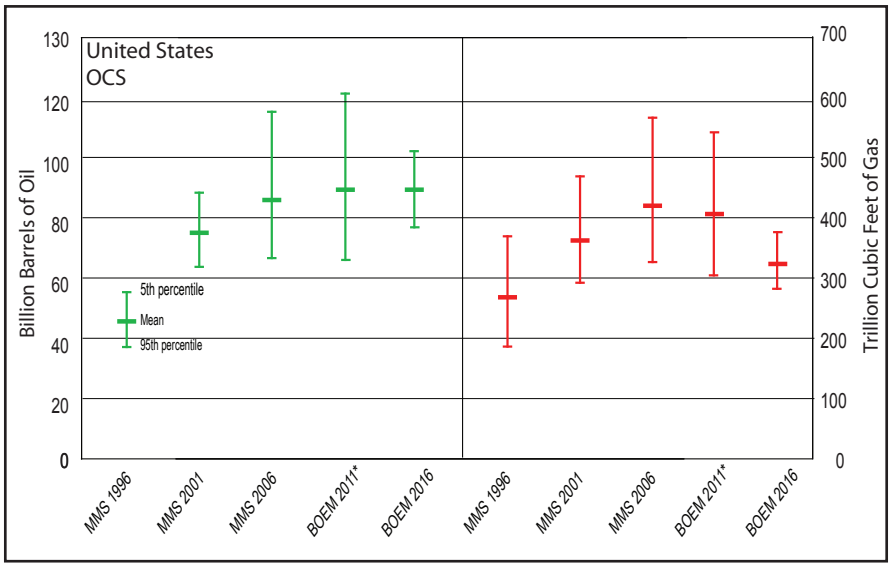

Figure 4. UTRR from BOEM 1995, 2000, 2006, 2011, and 2016 Assessments.

List of Terms

Analogous Reservoirs: Reservoirs that have similar rock and fluid properties, reservoir conditions (depth, temperature and pressure), and drive mechanisms, but are typically at a more advanced stage of development than the reservoir of interest and thus may provide concepts to assist in the interpretation of more limited data and estimation of recovery.

Contingent Resources: Quantities of petroleum which are estimated to be potentially recoverable from known accumulations, but which are not currently considered to be commercially recoverable.

Conventionally Recoverable: Producible by natural pressure, pumping, or secondary recovery methods, such as gas or water injection.

Cumulative Production: The sum of all produced volumes of oil and gas prior to a specified point in time.

Field: Area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same general geologic structural feature and/or stratigraphic trapping condition. There may be two or more reservoirs in a field that are separated vertically by impervious strata, laterally by local geologic barriers, or by both.

Play: A group of pools that share a common history of hydrocarbon generation, migration, reservoir development, and entrapment.

Pool: A discovered or undiscovered accumulation of hydrocarbons, typically within a single stratigraphic interval.

Probability: A means of expressing an outcome on a numerical scale that ranges from impossibility to absolute certainty; the chance that a specified event will occur.

Prospect: A geologic feature having the potential for trapping and accumulating hydrocarbons; a pool or potential field.

Reserves: The quantities of hydrocarbon resources anticipated to be recovered from known accumulations from a given date forward. All reserve estimates involve some degree of uncertainty.

Reserves Appreciation: The observed incremental increase through time in the estimates of reserves of an oil and/or natural gas field as a consequence of extension, revision, improved recovery, and the addition of new reservoirs.

Resources: Concentrations in the earth's crust of naturally occurring liquid or gaseous hydrocarbons that can conceivably be discovered and recovered.

Total Endowment: All technically recoverable hydrocarbon resources of an area. Estimates of total endowment equal the sum of undiscovered technically recoverable resources, cumulative production, remaining reserves, contingent resources and reserves appreciation.

Undiscovered Economically Recoverable Resources (UERR): The portion of the undiscovered technically recoverable resources that is economically recoverable under imposed economic and technologic conditions.

Undiscovered Resources: Resources postulated, on the basis of geologic knowledge and theory, to exist outside of known fields or accumulations. Included also are resources from undiscovered pools within known fields to the extent that they occur within separate plays.

Undiscovered Technically Recoverable Resources (UTRR): Oil and gas that may be produced as a consequence of natural pressure, artificial lift, pressure maintenance, or other secondary recovery methods, but without any consideration of economic viability. They are primarily located outside of known fields.

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For Further Information

Supporting geological studies, previous assessment results, and methodologies used by BOEM for resource assessment can be found on BOEM's web site, *www.boem.gov.*

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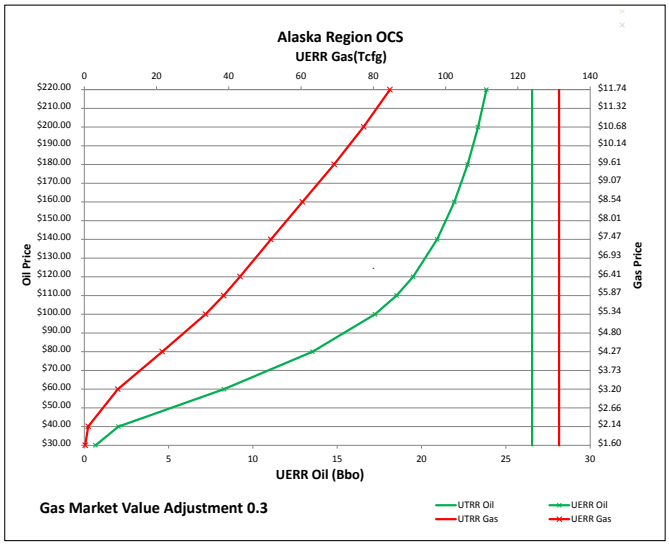
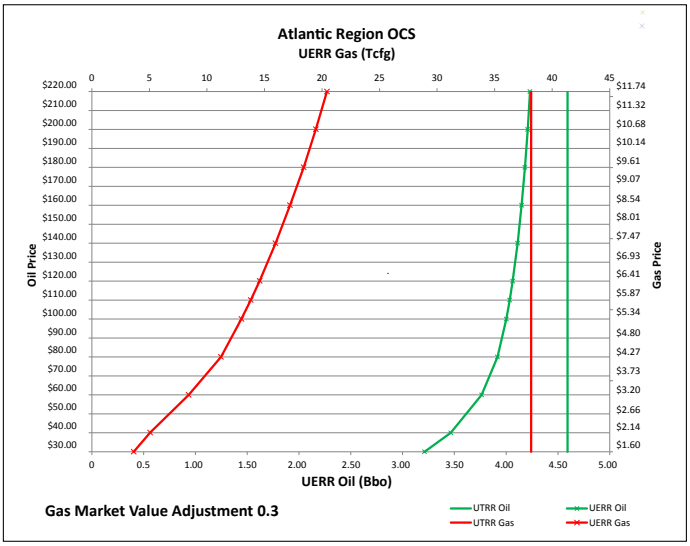
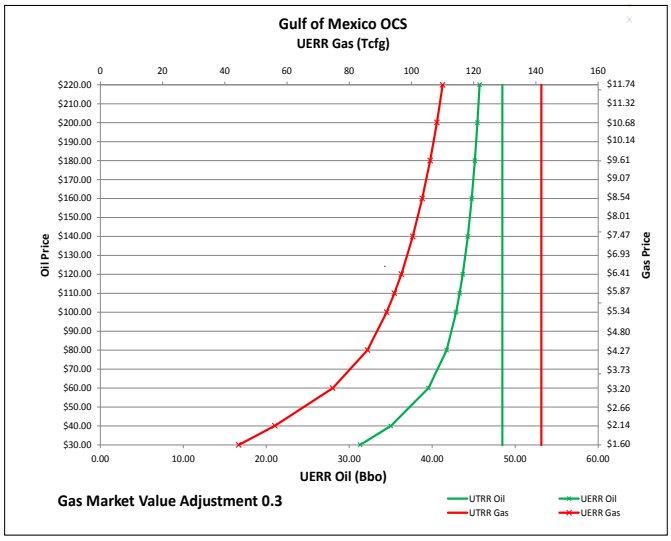
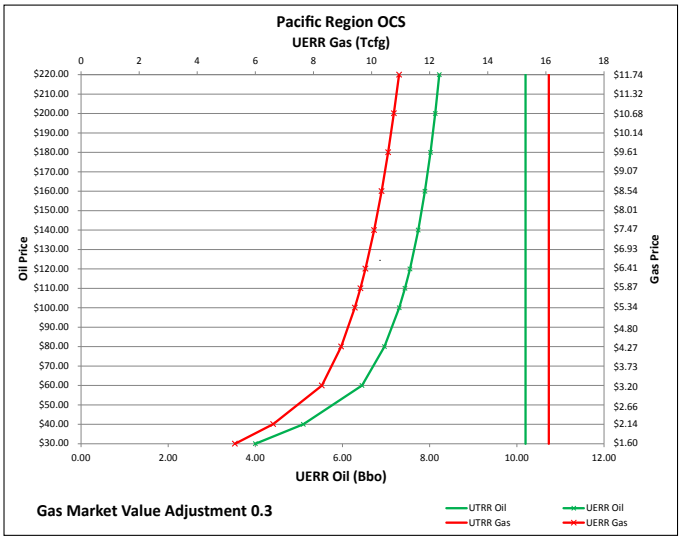
Appendix A

Price supply curves for the four OCS regions. Each graph shows the economic and geologic resources obtainable at various oil prices. In these graphs, oil prices are coupled with a specific gas price assuming a 30 percent economic value of gas relative to oil. Price-supply curves representing a 40 percent, a 60 percent, and a 100 percent economic value of gas relative to oil are available at www.boem.gov.









Appendix B

The graphs below show comparisons of UTRR by OCS region for assessments made in 1995, 2000, 2006, and 2011, and 2016. The bars represent the range between 95th and 5th percentiles for both oil and gas. Mean values are presented as a point on the range bars. Changes in estimates reflect subsequent production, discoveries, data acquisitions, and application of new or improved exploration and production technologies.