Outer Continental Shelf Committee: Future of Upstream E+P

OCS Board Workshop

January 31, 2018
US Outer Continental Shelf

- Defined by a series of parameters but basically 200 nautical miles from the baseline.

- Geologically the area is seaward of the shelf break which is approximately 600 feet water depth but the government uses 1,000 feet.

- Comprises 1.76 billion acres.

- MMS estimates the OCS contains 86 BBO and 420 Tcf of gas.

- Current production is 52 MMBO/month and 87 bcfg/month.

Assessment of Undiscovered Oil and Gas Resources of the Nation’s Outer Continental Shelf, 2016 (BOEM)
The intensity of discoveries varies considerably:

- Onshore US is dense
- Shelf fields follow trends
- Deep water US is relatively sparse, especially in the west
- Mexico offshore is barely scratched except for Sureste
• Since 1950, offshore has found 3,600 BBO, 40% of total discoveries

• Since 2006, offshore has found 314 BBO, 69% of total discoveries

• Discovery volumes have been decreasing since 2010 and have not shown any tendency to reverse the trend
Lower 48 OCS
The GOM is reaching a peak in production.

The Lower Tertiary has been able to offset declines in the Miocene and Plio-Pleistocene.
21 BBO and 29 Tcf have been found in the deep water Gulf of Mexico
12 BBO and 21 Tcf have been developed
9 BBO and 8 Tcf are being developed, appraised or are discoveries

**Appraising**

**Discovered and not being appraised**
### IHSM Deep Water GOM

<table>
<thead>
<tr>
<th>Reserve Size Categories (MMboe)</th>
<th>IHSM Reserves to Date MMboe</th>
<th>Number of Fields</th>
<th>Estimated Total Recoverable MMboe</th>
<th>Number of Fields</th>
<th>Yet-to-Find MMboe</th>
<th>Number of Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=50 and &lt;100</td>
<td>4,553</td>
<td>62</td>
<td>4,958</td>
<td>71</td>
<td>405</td>
<td>9</td>
</tr>
<tr>
<td>100 and &lt;250</td>
<td>8,334</td>
<td>55</td>
<td>7,747</td>
<td>50</td>
<td>0</td>
<td>0</td>
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<tr>
<td>&gt;=250 and &lt;500</td>
<td>5,784</td>
<td>17</td>
<td>5,917</td>
<td>17</td>
<td>0</td>
<td>0</td>
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<tr>
<td>&gt;=500 and &lt;1000</td>
<td>4,955</td>
<td>8</td>
<td>5,359</td>
<td>8</td>
<td>0</td>
<td>0</td>
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<tr>
<td>&gt;=1000 and &lt;2500</td>
<td>1,390</td>
<td>1</td>
<td>3,801</td>
<td>3</td>
<td>2,211</td>
<td>2</td>
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</table>

### IHSM Santa Barbara Channel

<table>
<thead>
<tr>
<th>Reserve Size Categories (MMboe)</th>
<th>IHSM Reserves to Date MMboe</th>
<th>Number of Fields</th>
<th>Estimated Total Recoverable MMboe</th>
<th>Number of Fields</th>
<th>Yet-to-Find MMboe</th>
<th>Number of Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=25 and &lt;=50</td>
<td>40</td>
<td>1</td>
<td>144</td>
<td>4</td>
<td>104</td>
<td>3</td>
</tr>
<tr>
<td>&gt;=50 and &lt;100</td>
<td>320</td>
<td>5</td>
<td>289</td>
<td>4</td>
<td>0</td>
<td>0</td>
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<tr>
<td>&gt;=100 and &lt;250</td>
<td>508</td>
<td>3</td>
<td>473</td>
<td>3</td>
<td>0</td>
<td>0</td>
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<tr>
<td>&gt;=250 and &lt;500</td>
<td>328</td>
<td>1</td>
<td>645</td>
<td>2</td>
<td>317</td>
<td>1</td>
</tr>
</tbody>
</table>

**Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation’s Outer Continental Shelf, 2016**

**Regional Totals:**
- Alaska OCS: 26.56 Bboe
- Atlantic OCS: 4.59 Bboe
- Gulf of Mexico OCS: 48.46 Bboe
- Pacific OCS: 10.20 Bboe
- Total U.S. OCS: 89.82 Bboe

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Over 3.5BBO is being appraised in the sub salt

600MMBO and 300+MMBO are being developed in the Norphlet and sub salt respectively
The recent average peak 6 month boe (20:1) is highest for the Lower Tertiary

- Lower Tertiary wells have been consistent, with few poor or high performers.
- Miocene wells have the potential to have the highest rates.
- Lower Tertiary wells have had the highest average rates since 2012.

<table>
<thead>
<tr>
<th>Age</th>
<th>Porosity Avg Pct</th>
<th>Perm Avg md</th>
<th>Water Saturation Percent</th>
<th>Break Evens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Plio Pleis</td>
<td>30</td>
<td>1010</td>
<td>23</td>
<td>$36.33</td>
</tr>
<tr>
<td>Average Miocene</td>
<td>29</td>
<td>720</td>
<td>25</td>
<td>$36.33</td>
</tr>
<tr>
<td>Average Lower Tertiary</td>
<td>21</td>
<td>242</td>
<td>29</td>
<td>$46.08</td>
</tr>
<tr>
<td>Average Jurassic</td>
<td>21</td>
<td>196</td>
<td>33</td>
<td>$44.96</td>
</tr>
</tbody>
</table>

Red Pliocene
Green Miocene
Orange Lower Tertiary
Project Economics Are Improving

Lower service costs, better design and more efficiency are decreasing project costs.

Multiple projects are expected to increase production over time.

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**Dev. forward breakeven changes 2014 to 2017 for key projects**

- **Mad Dog (Phase 2)**
  - 2014
  - 2017
  - 2017 with efficiency gains

- **Shenandoah**
  - 2014
  - 2017
  - 2017 with efficiency gains

- **Vito**
  - 2014
  - 2017
  - 2017 with efficiency gains

- **North Platte**
  - 2014
  - 2017
  - 2017 with efficiency gains

- **Kaskida**
  - 2014
  - 2017
  - 2017 with efficiency gains

**Source:** IHS

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**GOM Deepwater new source crude supply outlook**

- **Next wave of growth from Lower Tertiary**
- **Sanctioned**
- **Lower Tertiary**
- **Kaskida**
- **Tiber**
- **Shenandoah**
- **North Platte**
- **Vito**

**Source:** IHS

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Changes in Rig and Project Costs

Rig rates correlate to oil price

Only semi’s have declined recently

Lower Tertiary project costs

<table>
<thead>
<tr>
<th>Region</th>
<th>Cost Reduction from 2014 to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gulf of Mexico</td>
<td>-5.4% -17.2% -14.3% -36.9%</td>
</tr>
</tbody>
</table>
• Lower Tertiary fields are the largest with Mean reserves of 280 MMBO
• There are fewer Lower Tertiary fields than Miocene sub salt or Miocene
• Lower Tertiary P50’s are ~ 120 MMBO
• Sub salt Miocene P50’s are ~ 70MMBO
• Miocene P50’s are ~ 28 MMBO
• Round 249 had participation in the Lower Tertiary, Miocene Sub Salt and Perdido plays.

• Total, Shell, Chevron, Statoil, LLOG, Anadarko, Ridgewood, BP and Apache were awarded blocks.

• While the major plays were represented, the companies stayed close to existing licenses.
Alaska OCS and Artic
CARA Principle Findings

- The area is highly under explored making any resource assessment highly uncertain.
- The Chukchi Sea, Beaufort Sea, MacKenzie Delta, northeast Greenland, North Kara Sea and West Siberia are the most geologically likely areas for undiscovered resources.
- The oil resources are not large by world standards but the gas resources are large.
- CARA estimated 44-157 BBO and 770-2,990 Tcf of gas.
Introduction to the 2008 Circum-Arctic Resource Appraisal (CARA) Professional Paper
By Donald L. Gautier and Thomas E. Moore
Chapter A of The 2008 Circum-Arctic Resource Appraisal
Edited by T.E. Moore and D.L. Gautier

Assessment of Undiscovered Oil and Gas Resources of the Nation’s Outer Continental Shelf, 2016 (BOEM)
- West Siberia has the highest discovered reserves of 248BBOE and highest undiscovered resources of 126 BBOE.
- The North Slope and Chukchi have 30 BBOE discovered and 59 BBOE resources.
- Timan Pechora has 23 BBOE discovered and 54 BBOE resources.

<table>
<thead>
<tr>
<th>Region</th>
<th>Area (MMkm²)</th>
<th>Wildcat Wells</th>
<th>Discoveries</th>
<th>Discovered Oil BBOE</th>
<th>Discovered Gas BBOE</th>
<th>YTF Guatier BBOE</th>
<th>YTF Kontorovich BBOE</th>
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</thead>
<tbody>
<tr>
<td>Artic Alaska</td>
<td>0.5</td>
<td>317</td>
<td>61</td>
<td>23.1</td>
<td>6.8</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Mackenzie Delta</td>
<td>0.1</td>
<td>196</td>
<td>59</td>
<td>1.4</td>
<td>1.8</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Timan Pechora</td>
<td>0.2</td>
<td>646</td>
<td>142</td>
<td>12.4</td>
<td>3.6</td>
<td>54</td>
<td>15</td>
</tr>
<tr>
<td>W Sib + S Kara</td>
<td>0.7</td>
<td>426</td>
<td>92</td>
<td>22.0</td>
<td>226.3</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Norwegian Sea</td>
<td>0.1</td>
<td>38</td>
<td>12</td>
<td>0.7</td>
<td>0.7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>West Greenland</td>
<td>0.7</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>East Greenland</td>
<td>0.5</td>
<td></td>
<td></td>
<td>0.5</td>
<td></td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

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Atlantic Margin OCS
• No commercial discoveries to date
• 239,000 miles of seismic data, 51 wells
• Nine lease sales, 410 leases, 2,334,198 acres
• North, Mid and South protraction areas occupy 408,584 square miles
• The Baltimore Canyon Trough is the only well with ‘discoveries’ Eight wells had ‘wet’ natural gas shows indicating a mature oil and gas source rock.

Inventory of Technically and Economically Recoverable Hydrocarbon Resources of the Atlantic Outer Continental Shelf as of January 1, 2014

OCS Report
BOEM 2016-071
Atlantic Protraction Areas and Plays

The entire area has only been lightly explored. Deep water Cretaceous and Tertiary sands are unexplored.

U.S. Atlantic Assessment Units (AUs)

- Cretaceous & Jurassic Marginal Fault Belt AU
- Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin AU
- Late Jurassic–Early Cretaceous Carbonate Margin AU
- Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core AU
- Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension AU
- Cretaceous & Jurassic Blake Plateau Basin AU
- Jurassic Shelf Stratigraphic AU
- Cretaceous & Jurassic Interior Shelf Structure AU
- Triassic–Jurassic Rift Basin AU
- Cretaceous & Jurassic Hydrothermal Dolomite AU

4.6 BOEM Technically recoverable oil BBO
38 BOEM Technically recoverable gas Tcf
Sea level lowstands allowed sand to cross the shelf and be redepited as deep marine fans similar to the fans seen in West Africa.
• Canada is actively exploring and producing from their Atlantic Margin (Lake Erie as well)

• Hibernia (early Cretaceous deltaic sands), White Rose (Cretaceous shallow marine) and Terra Nova (Late Jurassic fluvial) produce from the Jeanne de Arc Basin

• Sable (Jurassic deltaic) gas produces from the Scotian shelf

• Shell has abandoned two wells off Nova Scotia, the Monterey Jack and Cheshire.

• BP have plans to drill in 2018
Executive order seeks to expand offshore drilling on Outer Continental Shelf:

- President Donald Trump last week signed the America First Offshore Energy Executive Order, which aims to expand offshore oil and gas exploration and production in the Outer Continental Shelf through a review of the five-year leasing program and reconsideration of certain regulations pertaining to offshore energy potential.

- The order also directs the Secretary of the Interior to implement a streamlined permitting approach for privately funded seismic data collection to determine offshore energy resource potential.

- The executive order directs the Secretary of Interior and Secretary of Commerce to take action on OCS restrictions. The Secretary of the Interior will review areas closed off by the current five-year plan for sale of oil and gas leases in the OCS, without disrupting scheduled lease sales.

- These planning areas include, but are not limited to: the Western and Central Gulf of Mexico, the Chukchi Sea, the Beaufort Sea, the Cook Inlet, and areas of the Mid and South Atlantic.

- Secretarial Order 3550 directs BOEM to immediately develop a new “Five Year Outer Continental Shelf Leasing Program” with full consideration given to leasing the OCS offshore Alaska, mid- and south-Atlantic, and the Gulf of Mexico.

- Under the (old) current five-year plan (2017-2022)—which was finalized in January, 2017 by the Obama administration—94% of the OCS is off limits for oil and gas development. As of March 1, 2017, only 16 million acres on the OCS (out of a total 1.7 billion acres) are under lease for oil and gas development.
Conclusions

- The Gulf of Mexico has ample discovered reserves. Some of these are being appraised and some are fallow.

- GOM costs have come down, oil price is better and there is exploration opportunity. However, the environment is marginal with economic challenges and political uncertainty.

- Offshore west coast has exploration potential but is unlikely to overcome local political opposition.

- Offshore east coast has not met with past exploration success.

- The bold may ultimately try exploring the deep water past the reefs where Cretaceous turbiditic sands are prospective.

- The Arctic has potential in the Chukchi and Beaufort Seas but the difficult operating environment and high costs are going to hamper commercial production.

- We wait to see what the new five year leasing plan is going to be?
  - Update 1: January 4, 2018 – Zinke Unleashes OCS
  - Update 2: January 10, 2018 – Florida removed from offshore drilling list