Offshore oil production

As I say often: in the world, for football game there are rules, umpires and red cards, but for oil production there is no rule, no umpire, no red card: most of the oil data is political because many countries lie on oil data, especially on reserves. There is no consensus on rules for oil definitions and in particular for water depths.

-water depth definition
The definition of deepwater depth varies between 125 m and 500 m:
- Uppsala >500 m
- WoodMac >500 m or 400 m
- IEA >400 m
- GOM BOEM >1000 ft = 305 m
- GOM BOEM 2019 >200 m
- Schlumberger >600 ft = 183 m
- EIA >125 m
- Rystad >125 m
- ASPO >125 m

-deepwater papers
The last paper on deepwater oil production is: Offshore magazine Dec 1, 2022: “Deepwater production set for steady growth, report finds. Global deepwater production should climb to 17 MMboe/d by 2030, according to Wood Mackenzie” = WoodMac

WoodMac defines deepwater as >400 m and forecasts deepwater peak in 2030 at 17 Mb/d. It is not clear if these data are real crude oil production as the unit is Mboe/d and not Mb/d. I have converted the above graph in digital data (2 significant digits).

Old papers on deepwater oil production:
-Uppsala U Fredrik Robelius 2007
Giant Oil Fields – The Highway to Oil

deepwater >500 m
Cumulative deepwater discoveries are less than 50 Gb:

![Graph showing cumulative deepwater discoveries](image1)

**Figure 7.3:** Cumulative global deepwater discovery in billion barrels (Gb) (OFN).
Deepwater oil production peak was forecasted in 2012 = it is wrong!

![Graph showing deepwater production forecast](image2)

**Figure 7.6:** Deepwater production forecast, in million barrels per day (Mbpd) based on OFN.
This 2007 forecast is wrong for 2022 (2 Mb/d) compared with real data about 10 Mb/d.

- OGJ Nov1, 2010 Raphael Sandrea
https://www.ogj.com/drilling-production/production-operations/article/17208264/deepwater-crude-oil-output-how-large-will-the-uptick-be

“Deepwater crude oil output: How large will the uptick be?”

Deepwater depth was >400 m as the source is WoodMac
2030 deepwater oil production forecast for 2030 was 11.1 Mb/d for an ultimate of 180 Gb:

- Ivan Sandrea Statoil 2011 “Potential consequences of the Gulf Oil Spill on future offshore
  https://studylib.net/doc/18220624/potential-consequences-of-the-gulf-oil-spill-on-future-of...
How important is deepwater?
Another source of oil supply, contributor to growth

Deepwater producers

Source: WM, 2010 production; Water depth > 500m; Oil and gas but share of gas is 17%; pie from PFC
How we got here?
Exploration water depth records broken every “decade”

Source: Statoil; WM; Water depth > 500 m

How we got here?
Drilling of ~200 wells per year, ~$30 bn pa

Source: WM; Statoil; Water depth > 500 m
How we got here? Discoveries by major players

Source: IHS; Bernstein; share of deepwater discoveries; water depth > 500m

How we got here?
Progressive development of production technology

Source: CGES, Statoil; Water depth > 500m; Days to first production from DB data using all offshore discoveries in last 40 years in over 300m of water depth
Uneconomic deepwater oil reserves. How will this change?

Source: Internal analysis, WM; excludes much of Brazil Pre-Sal due to uncertainties

Global deepwater positions. How will this change?

Source: Wood Mackenzie

Source: WM, water depth > 400 meters
Deeper, and ultra deepwater. How will this change?

Offshore oil production outlooks

Table 1: Offshore Crude Oil Production Capacity Outlooks through 2030

<table>
<thead>
<tr>
<th>Year</th>
<th>Shallow Water Production Capacity, million b/d</th>
<th>Total Offshore Production Capacity, million b/d</th>
<th>Deepwater Production Capacity, million b/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>19.2</td>
<td>400</td>
<td>4.1</td>
</tr>
<tr>
<td>2010</td>
<td>18.1</td>
<td>23.3</td>
<td>5.5</td>
</tr>
<tr>
<td>2015</td>
<td>14.2</td>
<td>20.5</td>
<td>6.3</td>
</tr>
<tr>
<td>2025</td>
<td>7.3</td>
<td>12.4</td>
<td>8.9</td>
</tr>
<tr>
<td>2030</td>
<td>4.5</td>
<td>8.8</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Source: Sandrea 2010; O&G Journal
- Laherrere J.H. 2012 « Updating deepwater oil & gas discovery » April

With ultimate for deepwater >200 m is about 200 Gb
- offshore oil production
Thanks to Hugo Duterne (ASPOFrance data = https://www.gostatit.com/aspo_france), the world offshore oil production displays a plateau since 2010 where the deepwater (>125 m) is increasing.

Hugo Duterne 11 juillet 2023
HL of deepwater >125 m oil production trends towards 225 Gb (not far from my 2012 estimate >200 m of 200 Gb from creaming curves).

The deepwater peak for $U = 225 \text{ Gb}$ will be around 2027 at 10.7 Mb/d.

Jean Laherrere July 2023
For shelf <125 m (shallow) oil production the ultimate is 500 Gb

Giving a past peak in 2004 at 7400 Mb/a = 20 Mb/d
For the offshore liquids production HL trends towards 650 Gb (when the sum deep and shelf is 725 Gb)
The comparison with my deep forecast (orange >125 m) and WoodMac (purple >400 m) shows that WoodMac is too optimistic, when compared with IEA/WEO2022 forecast (purple triangles) as EIA/OEO2018.

Offshore oil (liquids) production has peaked in 2016 at 28 Mb/d, when IEA (OEO2018) forecasts peak beyond 2040.

The deepwater oil production displays large variations with different sources and depth definitions:

Jean Laherrere July 2023
WEO2022 forecasts deepwater oil production at 9.5 Mb/d in 2035 against a WoodMac forecast of 16.4 Mb/d in 2032 = large difference!

WoodMac sells most of their reports (k$) and few are free: In June 2019 Deepwater investment bounces back [https://www.woodmac.com/news/the-edge/deepwater-investment-bounces-back/] deepwater >400 m remaining oil commercial reserves are reported at 30 Gb

The cumulative production of WoodMac graph on deepwater production 1990-2032 is 110 Gb (Gboe?), with only 55 Gb from 1990 to 2022: if remaining reserves (30 Gb) are less than cumulative production, the peak is past!

But IEA/OEO2018 for WEO2017
reports deep (>400 m) reserves (reserves are always recoverable!) at 224 +78 = 302 Gb (275 Gb remaining)

<table>
<thead>
<tr>
<th>Table A.1</th>
<th>Oil resources and reserves (bbl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Technically recoverable reserves</td>
</tr>
<tr>
<td>Conventional oil</td>
<td>4 126</td>
</tr>
<tr>
<td>Conventional</td>
<td>2 247</td>
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<tr>
<td>Shallow offshore</td>
<td>795</td>
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<tr>
<td>Deep offshore</td>
<td>224</td>
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<tr>
<td>Ultra-deep offshore</td>
<td>78</td>
</tr>
<tr>
<td>Other</td>
<td>782</td>
</tr>
<tr>
<td>Unconventional oil</td>
<td>3 411</td>
</tr>
<tr>
<td>World total</td>
<td>7 537</td>
</tr>
</tbody>
</table>

Notes: bbl = billion barrels; TRR = technically recoverable reserves.
Source: IEA (2017a).

For NG
Production of shallow water from 2000 to 2016 is much more than deepwater

The forecast for NPS for 2040:
There are many offshore installations in the North Sea.
WEO2018 NPS (SP today) forecasts deepwater >400 m oil peak beyond 2040 at 10 Mb/d (and not 17 Mb/d for WoodMac)
The last deepwater oil discoveries are in Brazil, Guyana (Liza et al 10 Gb), in Senegal (Baleine 1 Gb), South Africa and Namibia (Venus 2 Gb, Graff 1 Gb), nothing to explain the WoodMac increase of production beyond 2022.

Petrobras reports for Q12023 deep production of 0.38 Mboe/d against 0.47 Mboe/d for 1Q2022: a decrease and not an increase!

But Petrobras has sold in Q12023 100% stake in deep water exploration and production (E&P) assets, located in the Espirito Santo basin, Brazil, to BW Energy’s subsidiary BW Energy Maromba do Brasil (BWE).

Petrobras is a leader in deepwater production:
Conclusion
As there is a very large range on deepwater depth definitions (from 125 m to 500 m), deepwater oil production varies with sources. It is likely that deepwater oil production will peak in few years around 11 Mb/d and not 17 Mb/d as forecasted by WoodMac (>400 m). Nothing seems to justify the sharp increase in WoodMac graph beyond 2022, which disagrees with IEA forecast. Deepwater >125 m oil production will peak in 2027 at 10 Mb/d for an ultimate of 225 Gb, when shallow <125 m oil production has peaked in 2004 at 20 Mb/d with an ultimate of 500 Gb: deep water oil represents only half of shallow water oil. Offshore oil (liquids) production has peaked in 2016 at 28 Mb/d. Future oil deepwater will not save the oil coming decline.